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First Aeronautical Weekly in the World : Founded 1909

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The Outlook

Security Forces

THE Prime Minister's great speech last Wednesday dealt with foreign policy, and it was therefore only natural that the air should not figure largely in it. Some passages showed how foreign policy and the possession of airfields can be closely connected. The relations of Britain with Spain, now so happily improved, seemed once in a critical state when we had 600 aircraft lined up on the airfield at Gibraltar in full range and full view of the Spanish guns. At the other end of the Mediterranean, negotiations with Turkey centred largely round the prospect that the Ankara Government would allow us to use air bases in Turkey as part of an offensive to dominate the Ægean Sea. Those negotiations failed, and, as a result, Leros and Samos are unhappy memories.

The remark that our two great Allies "in some forms of power far exceed the British Empire" was also interesting. Everybody knows that in land strength we cannot equal Russia, while the days are past when the only guarantee for the Monroe Doctrine was the British Navy. There is no question of quarrelling with either of those Allies, but the use of the word "some" by the Prime Minister suggests that Britain can always secure the safety of her home islands by maintaining in sufficient strength the force which we know as A.D.G.B.

Looking to the future of Europe, Mr. Churchill used one very pregnant phrase. Referring to some future efficient successor to the League of Nations, he said, in very definite words: "Measures will be taken to have ample armies, fleets and air forces available" to prevent future aggressions.

In the inter-war years there was much talk about an International Air Force. It was assumed that, because a blow from the air can be made more quickly than one by either sea or land, therefore a bomber force would by itself be enough to restrain incipient aggression. By this time ideas have advanced beyond that crude conception. An airborne force of soldiers (combining the advantages of both Army and Air Force) might be very useful for that purpose—far more useful than a bomber force. But ideas of war now run entirely on the lines of combined operations by all three Services, and one feels much greater confidence for the peace of Europe now that the Prime Minister has specifically mentioned all three as constituting the security force of the future.

Staff Work

FOR weeks past the public has been reading every day about air assault on the enemy's communication centres in Western Europe and along the coasts. These attacks have been carried out by heavy bombers, medium bombers, fighter-bombers, and fighters, and by daylight pretty well every bombing raid has been escorted by swarms of fighters.

The communiqués issued by the Air Ministry have usually stated the Command which has provided the bombers for each raid, and also the Command which has supplied the fighter escort. Probably not many readers have given much thought to the intricate organisation implied by these statements. During the period of waiting before the invasion it was only obvious common sense for the Allied chiefs in Great Britain to pool all their air resources, and throw in every available aircraft while smashing up the German communications and so preparing the way for the invading troops.

It is, however, one thing to say that such-and-such a step is obvious common sense, and it is quite another thing to put the plan into practice. Just consider the main organisation of air power in the West. General

Eisenhower is Supreme Allied Commander for the liberation of Europe, and under him Air Chief Marshal Sir Trafford Leigh-Mallory commands the Allied Expeditionary Air Force. Under Leigh-Mallory are the Second Tactical Air Force commanded by Air Marshal Sir Arthur Coningham, the U.S. Army Ninth Air Force, which was brought up from the Mediterranean to this country, and Air Defence of Great Britain under Air Marshal Sir Roderick Hill. Of these the two first-mentioned comprise both bombers and fighters.

But there are two Commands which do not come under General Eisenhower, namely, Bomber Command under Air Chief Marshal Sir Arthur Harris, and the U.S. Eighth Air Force under General Spaatz. General Spaatz also has under him the U.S. Army Fifteenth Air Force which is based in the Mediterranean, but with that we are not at the moment concerned. Both these strategic forces have been taking part in the disruption of German communications. Bomber Command, working by night, does not need fighter escorts, while the Eighth Air Force possesses its own escort fighters.

AT HIS FINGER TIPS : The bomb-aimer of a Lancaster—bomb release in hand—and the load of destruction which he can select at will. The big fellow is a 4,000 lb. bomb.

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All the raids have had to fit into one coherent plan, and the day raids by medium bombers of the Second Tactical Air Force and the Ninth Air Force have been protected by fighter escorts, though not always by fighters of their own Command. Sir Trafford Leigh-Mallory has not kept A.D.G.B. kicking its heels on its airfields, but has regularly sent its fighters across the Channel to escort the bombers of the other two Commands. Arranging these escorts must have called for excellent staff work of a very intricate nature. Beyond that, there is no one authority responsible for fitting into one coherent whole the work of the heavy and the medium bombers. That jig-saw puzzle has been solved somehow, though the manner of the solution has not been revealed to the man in the street. The one thing obvious to all is that the air staff work has reached a zenith, and the staff officers deserve all praise. They also serve who only sit at office tables.

Aircraft in Mountain Warfare

KESSELRING is a *Luftwaffe* officer, although he was placed in command of the German armies in Italy. In Libya he had commanded the *Luftwaffe* contingent which worked (though not too closely) with Rommel. When he was given the command in Italy he must have been told that he would have but a minimum of air support, and must manage without it. He accepted the position, doubtless thanking his stars that the fighting would be in the Apennines.

Kesselring knew, as every General and Air Marshal must know, that when troops are entrenched in mountains they should be able to hold their lines even though the assailants bring unchallenged air power against them. For months on end Kesselring was justified. It should be noted that those were winter months, when the movements of troops were circumscribed.

The coming of spring brought a change. The Allied infantry and artillery broke the German lines, and that reacted on the air position. The railways behind the German positions had been so battered from the air that but little use could be made of them ; but the Germans had performed wonders in working along the roads at night. Once the troops of General Alexander began to press forward these night movements did not suffice, and transport had to move by day, both to the north of Rome and nearer the front. That gave the Allied aircraft their chance, and they fell upon the transport with deadly effect. Once again General Alexander has shown how to use ground and air power in proper relation.

WAR in the AIR

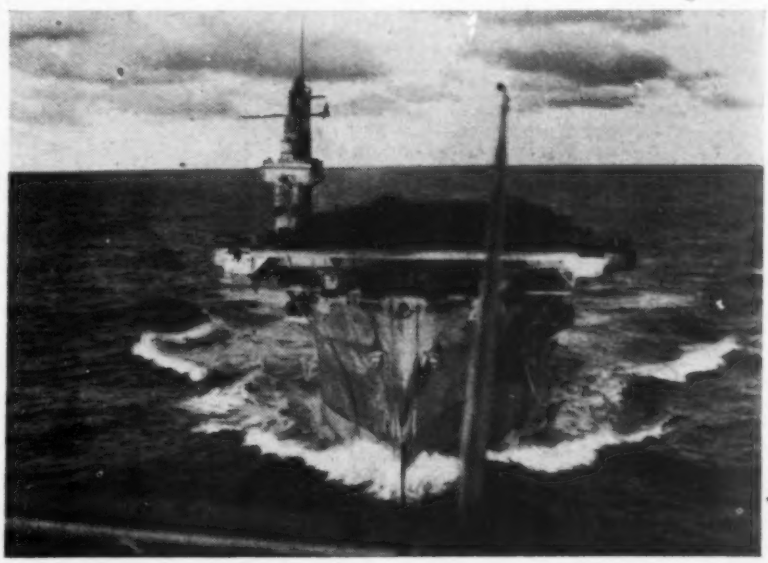
Edging Nearer to Japan : Maximum Air Effort in Italy : Western Communications Bombed and also Berlin

BARREL BLAST BAYS : Italian wine casks filled with earth form the foundations of blast-protection walls for an Allison-engined Mustang on an airfield in the Anzio beachhead.

A VERY significant happening in recent days was the bombing of one of the Bonin Islands by an American Liberator. The Bonin Islands are not much over 500 miles from Yokohama, in Japan, and, as the aircraft flies, 500 is quite near. Bombing a place is not the same as establishing an air base there, and the time is not imminent when the inhabitants of Tokyo will have their complacency disturbed by the crash of falling bombs, or see their wooden dwellings blazing by the thousand as the incendiaries rain down; but certainly the Allies are edging nearer to the land of Nippon, and this raid on Bonin is surely the shadow of coming events.

The Allied peoples are now in a mood of optimism. It is, nevertheless, a mistake to overstate a case, for that is apt to result in disappointment, followed by depression. Gen. Arnold, Chief of the U.S. Army Air Forces, is reported to have said at Chicago the other day that the Allied bombing of German-held territory constituted an invasion "in the deadliest sense of the word." We cannot agree with the General that bombing is at all the same as an invasion. The latter implies occupation, which can only be achieved by an army. The bombers fight battles, very bitter battles, then destroy the enemy's resources to the best of their ability, and finally come home. That their brave work will ease the difficulties of the invading Army is the hope and belief of everyone in the United Nations, but it is not itself invasion.

The R.A.F. and the U.S. Army A.F. are accentuating the paper shortage in this country by continuing to drop leaflets and other publications all over Germany and occupied territory. These relations of true facts will certainly raise the *moral* of the enslaved peoples, and it is worth a good deal to bring a little happiness into their lives. The pamphlets are not likely to impair the fighting efficiency



IN NORTHERN WATERS : Escort carrier H.M.S. *Chaser* as seen from a Swordfish which has just left her deck. H.M.S. *Chaser* played an important part in the recent Russian convoy action when at least two U-boats were sunk.

WAR IN THE AIR

of the German soldiers as yet, but they may do something to prepare the way for a collapse of *moral* later on. Göbbels has always relied on lies to keep up the spirits of his people, and the great confounder of lies is truth. "What is truth?" asked Pontius Pilate, and other philosophers have pointed out that it is always possible to tell a true story in two ways with opposite implications. Had Dr. Göbbels realised that, and stuck to his version of the truth, he might be harder to refute. As things are, he cannot command such credence, and so the truths contained in the leaflets will be all the more telling. The export of good British paper may, after all, be well justified.

In a number of recent communiqués it has been stated that there had been slight air activity over Northern Scotland, but that no bombs had been dropped. Evidently the Germans are very anxious to learn what is happening on all parts of the British coastline, and the reconnaissance aircraft would be foolish to draw attention to themselves by dropping bombs. Doubtless the Germans argue that if a descent on Norway were in contemplation, there would be signs of preparations for it at Tain and Invergordon. We shall leave them to their speculations.

The "Heart-shaking" Battle

THE Tactical Air Force in Italy went all out, as one was sure that it would, to help the Allies in what the Prime Minister called "the heart-shaking battle" in Italy. There have been reports of 150 enemy vehicles destroyed in one day, and of railway trucks and other conveyances bombed behind the enemy's lines. The greatest testimony to the work of the M.A.A.F. has been the German inability to bring up sufficient reserves to stage a prompt major counter-attack. The 26th Panzer Grenadiers was brought down from its position as reserve behind the Anzio beach, where it was probably the only reserve, to reinforce the main battle front, and this seems to show that the persistent bombing of railway centres round Rome and elsewhere has had a seriously crippling effect on the Germans' power of moving formations. Soon after the 26th had gone, the troops at Anzio began an advance. The enemy must surely have expected this move, and if so, the removal of reserves was a policy of desperation.

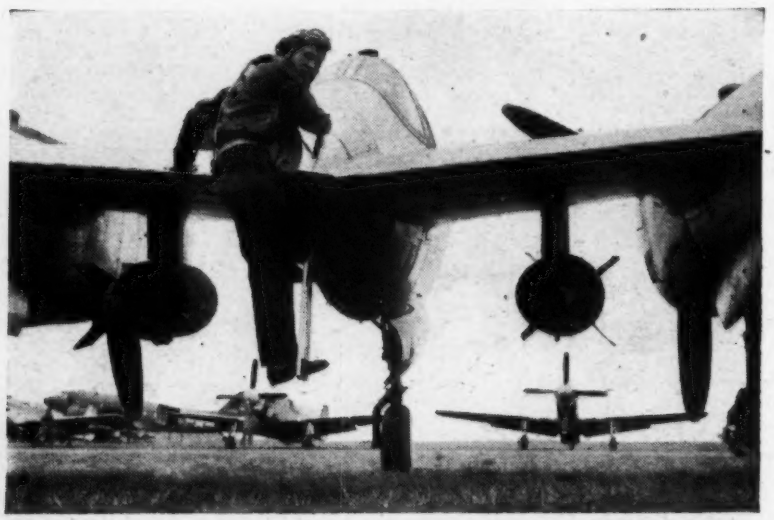
AIR SUPERIORITY BY BOMBING: Japanese Mitsubishi 96s burning on the ground after an attack by U.S. bombers on the Shinchiku airfield in Formosa.

Last week the air offensive against the German communication centres was carried on with the utmost vigour. Communications were the first priority of air attack, and British and American heavy bombers both lent a hand. The unspecified military objectives in the Pas de Calais were also regularly visited, sometimes by big Liberators.

None the less, the heavies of both nations found time to devote attention to targets which are more in their regular line of business. Duisberg is both a centre of communications and also of production, and when it was attacked by Lancasters one recent night the enemy fighters were not kept aground, but were let loose in swarms. The Lancaster crews reported that the enemy used a new form of flare, which travelled across the sky horizontally before ending its career in an explosion.

Berlin was attacked several times, by the R.A.F. at night and the Americans by daylight. The Reich capital also has a double importance, as a centre of production and of communications. Many other places felt the weight of the wrath of the two Allied Air Forces, but naturally, at the moment the public takes more interest in raids which are calculated to have a direct effect on the Germans' ability to contest the invasion than on any other form of air activity. Everybody wants to see the enemy as powerless to move his reserves quickly about Western Europe as he evidently is to move them at will to the crucial points in Italy.

It was interesting to note how the Russians sat grimly on in their lines at the foot of the Carpathians, waiting for the moment when blows from East



LIGHTNING LOAD: The Lockheed Lightning, in common with all other Allied fighters, is adapted to take either extra fuel tanks or bombs in external racks. On the Lightning the racks are between the engines and the cockpit.

WAR IN THE AIR

and West could be made to synchronise.

One wonders sometimes whether war correspondents at the front do not get confused by the latest organisation of British and American Air Forces. One message from Allied Headquarters in Italy reported that heavy bombers of the M.A.A.F. attacked the railway yards at Lyons and Toulon. Naturally it must seem to correspondents in the Mediterranean that all bombers based there form part of the Mediterranean Allied Air Force. For maintenance purposes it is true that they do, but operationally the U.S. Army 15th Air Force is not under Gen. Eaker (who commands M.A.A.F.) but under Gen. Spaatz, whose H.Q. are in Great Britain. The latter has two forces of heavy bombers (with long-range fighters for escort duties as well) under his operational command—the 15th Air Force in the Mediterranean and the 8th Air Force in the British Isles. It seems to have been the 15th A.F. which made the raids on Toulon and Lyons. Lyons was the most northerly point which heavy bombers from the south had reached. They were escorted all the way by Mustangs and Lightnings.

The Overriding Need

THE alternate attacks from north and south must place a great strain on the German defence organisation. Its overriding need is to preserve a force of fighters to meet the Allied invasion, while at the same time those fighters have to fight for specially valuable spots, such as aircraft factories. In consequence, if the absence of fighters means defeat in one of the land battles, the German High Command decided some time ago to accept that.

It would take a tremendous force of German fighters to disturb the air supremacy which the Allies have established in Italy, and no serious effort has been made by the Germans in that direction. Small packets of their aircraft have appeared there every now and then, but so seldom that their appearances have been reported as something quite surprising.

These spasmodic appearances of German aircraft usually ended in the loss of a high percentage of their number. On some days the Allies have admitted losing even more than the enemy had done, but in proportion to sorties the Allied losses were tiny.

ON A NEW ROUTE: Sqn. Ldr. Orlinski, one-time record breaker on Warsaw-Tokio flight, now flies a Mosquito from Britain to Germany very frequently.

SOME FOR ME: Fortresses of the 15th U.S.A.A.F. attack the main Messerschmitt factory at Wiener Neustadt, south of Vienna.

Wise Words

THE Air Staff has never pretended that it hoped to win this war by the bomber offensive alone. Last January there was an interesting talk between a gathering of journalists in Washington and Air Marshal Sir Richard Peck and Gen. Spaatz in London, in the course of which Sir Richard said: "I think that whatever form victory takes it will not have been won by air warfare alone, because air warfare has not been employed alone."

The same point has been rubbed in even more emphatically by Air Marshal Sir Arthur Coningham, A.O.C. the Second Tactical Air Force. Speaking to the Spitfire squadrons of his Force the other day he said: "It is quite impossible for any one Service to win a modern war. . . . There is no short cut to beating the Germans, and you cannot do it by bombing alone." He then repeated Gen. Eisenhower's dictum that all the Allied forces, the Army, Navy and Air Force, British, American and Allied, constituted one big team.

That is the doctrine which has been consistently preached by *Flight* ever since the outbreak of this war. It has been questioned, and even denied, by many who thought themselves cleverer than the authorities of the Royal Air Force. The intense public interest aroused by the steady growth of the R.A.F. and U.S. heavy bomber forces, and the periodical statements of the amount of damage done to Berlin, Essen, Hamburg and other places no doubt inclined the public to take an exaggerated view of the effects of the bomber offensive, but Air Marshal Coningham's words should bring a proper sense of proportion.

HERE AND THERE

SEEING FOR HIMSELF: Sir Stafford and Lady Cripps recently visited the Blackburn aircraft factory, travelling there by air. Comdre. Slattery (Chief Naval Representative), Sir Stafford, Capt. Norman Blackburn and Mr. Robert Blackburn are here seen crossing the tarmac.

To What (Naval) Base Uses!

THE Martin Marauder is now in service with the U.S. Navy, who call it the JM-1. This version is being used as a target tug at the Norfolk Naval Base, Virginia.

The Setting Sun

VICE-ADMIRAL AUBREY W. FITCH, formerly commander of aircraft in the South Pacific, recently said that though the Jap air force was not running away, it was now definitely on the defensive.

India Air Routes

ACCORDING to a ten-year plan for Indian aviation, the Government is to take over R.A.F. airfields as required after the war. The India Office stated that 75 airfields would be provided at a cost of £12,000,000.

Aircraft Outputs

RECENTLY issued production figures from across the Atlantic show that Canada built a total of 7,390 aircraft in 1943, of which 3,257 were assembled from imported components. The American industry has produced 153,061 aircraft during the past three years and present production is at the rate of 350 a day.

KLM to Buy Tudors?

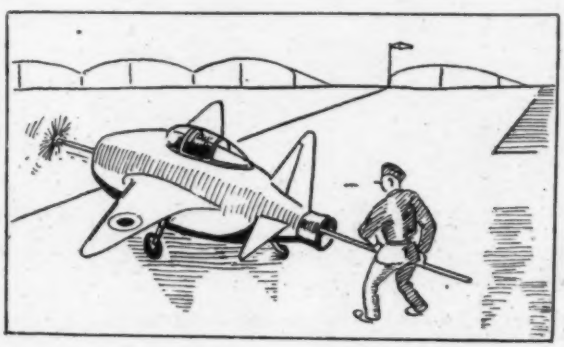
REPORTS that the Royal Dutch Airline (KLM) have ordered a number of 32-ton Avro Tudor civil airliners are said to have aroused a certain amount of concern in U.S. aircraft manufacturing circles, especially as a KLM director recently visited American companies to look over their products.

The KLM director is reported as saying: "It has always been KLM's policy to buy where the company finds, at the right time, the best material for its air services."

Helicopters in Action

HELICOPTERS are now being used in the airborne invasion of Burma by American units of the Third Tactical Air Force, Eastern Air Command, says a recent *Reuter* message from Calcutta.

The pilots were selected from a group of volunteers in the U.S., who underwent a special course of training at the Sikorsky factory at Bridgeport, Connecticut, and arrived in India by air. With them arrived their machines, ground crews and technicians.



U.S. Decorations

COL. ELLIOTT ROOSEVELT, second son of the U.S. President, has been awarded the C.B.E., which was recently presented to him by Air Chief Marshal Sir Trafford Leigh-Mallory; the decoration is for his leadership in operations in the North-West African campaign when he commanded a photographic reconnaissance unit which did invaluable work.

* * *

COL. LESLIE P. ARNOLD, Commanding Officer of the Ferry Service of the U.S. Air Command, has been presented with the Legion of Merit by Lt. Gen. Carl Spaatz, Commander of the U.S Strategic Air Forces in Europe, for his services in connection with the ferrying of combat aircraft to their operational bases from their landing point in England.

Words of Warning

A WARNING against the too comfortable notion that the *Luftwaffe* was now as good as written off was given by Wing Cdr. Hodsell, Inspector General of Civil Defence, addressing a recent meeting of the Industrial Passive Air Defence Officers' Guild in Birmingham.

"Don't let us get the idea that we have knocked out the German Air Force yet," he said. "The Germans are conserving themselves a good deal. Let us work on the assumption that he is still formidable and will put forth his last ounce to stave off what he knows is the last phase."

"Pennies for Planes"

THIS is the new slogan of the Air League of the British Empire which has hit upon the neat idea of asking British citizens to subscribe a penny every day on which they see an aircraft.

This being Leap Year, the idea should bring in 30s. 6d. per head per annum—if you see what we mean!

Well Deserved Holidays

WE who must forgo our summer fortnights by the sea should be glad to know that our airmen on the Italian front are being provided with really pleasant surroundings in which to spend a few days' restful leave.

Some of the best hotels in Southern Italy's seaside resorts, and a number of large summer villas of wealthy Italian landowners are at their disposal.

Glider-Commander's D.S.C.

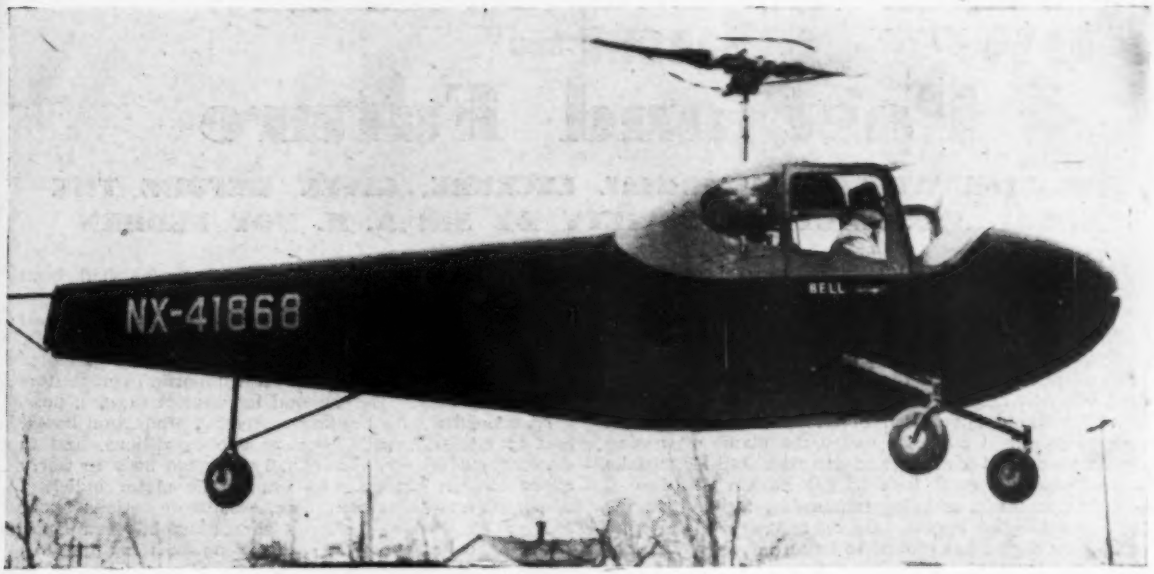
LT. COL. WALTER PUCELL SCOTT, M.C., commander of the men who made the initial glider landings with the late Gen. Wingate's airborne division in Burma, has been awarded the Distinguished Service Cross.

The American D.S.C., which ranks next to the Congressional Medal of Honour, is a bronze cross with the inscription "For Valor," and is given for "extraordinary heroism in armed operations."

G.B.'s Aid to U.S.

HANDSOME acknowledgment of the aid given to America by Britain in the shape of reverse Lend-Lease is made by President Roosevelt in his Fifteenth Lend-Lease Report issued the other day.

The total value of this reciprocal aid to the beginning of the present



BELL-HOP : Designed with an eye to civilian use after the war, this Bell helicopter recently made its public debut in the U.S. Its immediate sphere is rescue and reconnaissance.

HERE AND THERE

year is quoted at $1,526,170,000 (over £380,000,000), and ranges from airmen's socks to complete air stations, while the weight of equipment and supplies alone is 452,000 tons. (See page 585.)

Included in a sample list of items are 35,000 108-gallon belly tanks for fighter aircraft, and another 43,000 easily jettisoned lightweight fuel tanks for long-range fighters.

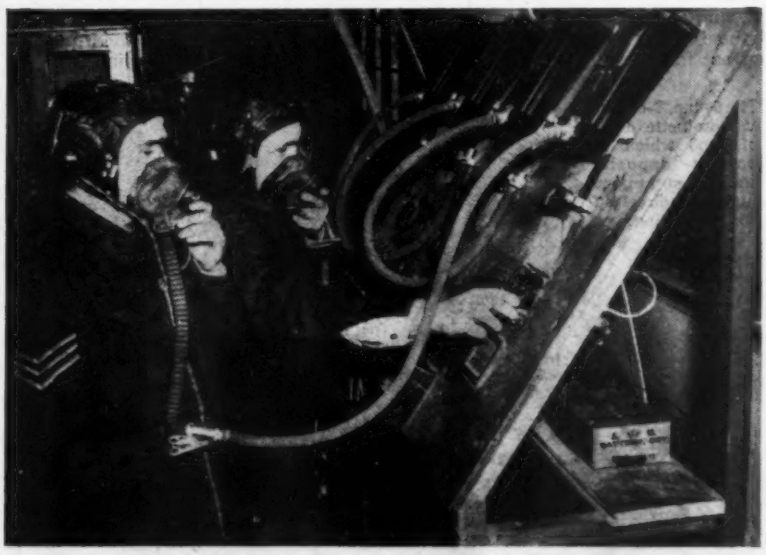
More Transatlantic Trips

B.O.A.C. is to increase its service between Baltimore and Foynes (Eire) from two to three flights per week in each direction. The necessary order permitting this increase, as a war necessity, has been issued by the U.S. Civil Aeronautics Board on the recommendation of the Department of State and at the request of B.O.A.C.

Flying "Waafs"

FOR the first time in the history of the R.A.F., members of the W.A.A.F. undergoing training as Signals Officers are to be given the opportunity of studying their subject from the air-to-ground point of view.

Hitherto all their training has been done on the ground, but now, as an experiment, they will round off their normal course with a week at an airfield where they will fly as do their R.A.F. counterparts. This will enable them the better to appreciate the difficulties encountered by aircrews, which will be all to the good when they are finally posted as qualified Signals Officers.



ROUTINE TEST : An R.A.F. sergeant and an Australian flying officer test the oxygen equipment in the crew-room of an R.A.A.F. Lancaster before take-off.

Canadian-Soviet Air Talks

MR. GEORGE ZARUBIN, Russian Ambassador to Canada, who recently visited Edmonton on his way from Moscow to Ottawa, said he was certain that Canada and the Soviet Union would soon have discussions on post-war air plans similar to those held by Russia, the U.S. and Britain.

"All signs and reasons point towards a continuance of good relations between Russia and Canada," he added.

Brewster's Navy Contract

THE U.S. Navy Dept. recently announced the termination of its contract with the Brewster Aeronautical Corp. as part of the reduction in fighter aircraft production previously announced. Corsair fighters are chiefly concerned, about half the original contract for 1,500 Corsairs having been completed.

Less Frostbite

DURING the last 12 months, cases of frostbite among flying personnel of the U.S.A.A.F. based in Great Britain has been reduced from 60 in 10,000 to 4 in 10,000.

According to Brig. Gen. Malcolm C. Grow, the Chief Surgeon of the U.S. Air Service Command, the chief factors in this tremendous reduction are improved electrically heated flying clothing, face masks and gloves, and the new windows for waist gunners on Fortresses and Liberators.

Use of Light Metals

WITH the object of securing the best use of hiduminium alloys, a new company—Hiduminium Applications, Ltd.—has been formed by High Duty Alloys, Ltd., Reynolds Tube Co., Ltd., and Reynolds Rolling Mills, Ltd., to collaborate with designers and constructors in any industry. Information can be obtained on request to the new concern at Farnham Road, Slough, Bucks.

D

Power Plant—Past and Future

THE 32nd WRIGHT MEMORIAL LECTURE, GIVEN BEFORE THE ROYAL AERONAUTICAL SOCIETY BY SIR A. H. ROY FEDDEN

THIS year's Wilbur Wright Memorial Lecture, the thirty-second in the series, was given by Sir Roy Fedden. The written lecture is a stupendous contribution, and Sir Roy read an abbreviated version, of which the following is a summary:—

My subject deals with the internal combustion engine, about which it has but recently been publicly stated that the world would have been better off had it not been invented at all. I feel that to lay the blame of causing wars at its door is a wrong and defeatist attitude to take up, and that we must look to the human qualities of greed and ambition as being responsible, rather than the internal combustion engine. On the contrary, the internal combustion engine has proved to be an increasingly faithful servant to mankind.

Practical realisation of mechanical flight was achieved by the Wright Brothers in America some 40 years ago, by means of a four-cylinder engine which they had to design and construct themselves. Throughout the intervening 40 years, each stage of advancement of aircraft has been waiting on an improvement in the prime mover.

For nearly thirty years of this period it has been my good fortune to be connected with aircraft power plant, and to watch its development, which has been one of the most intriguing efforts of mechanical endeavour in history. Interesting and instructive though this period has been, most of the urge has been inspired by fear, and fostered by preparation for war. Technically we are, I believe, on the threshold of an even more interesting period of unfoldment in the history of power plant for aircraft, and with the steady increase in aircraft speed, it is essential to evolve a prime mover that is more intimately concerned with, and closely woven into the structure of, the aircraft itself.

Necessity for Technical Training

This country has for a number of years taken a leading place in aircraft power plant development, and we must see to it that we continue to do so in the future, for policing purposes and for civil aviation, but not for a new race in armaments. The most practical way of doing this, in my opinion, is to provide a large enough team of highly trained, keen and enthusiastic engineers, with ample modern research and development equipment, and to be sure that, above all things, we maintain our technical superiority and initiative.

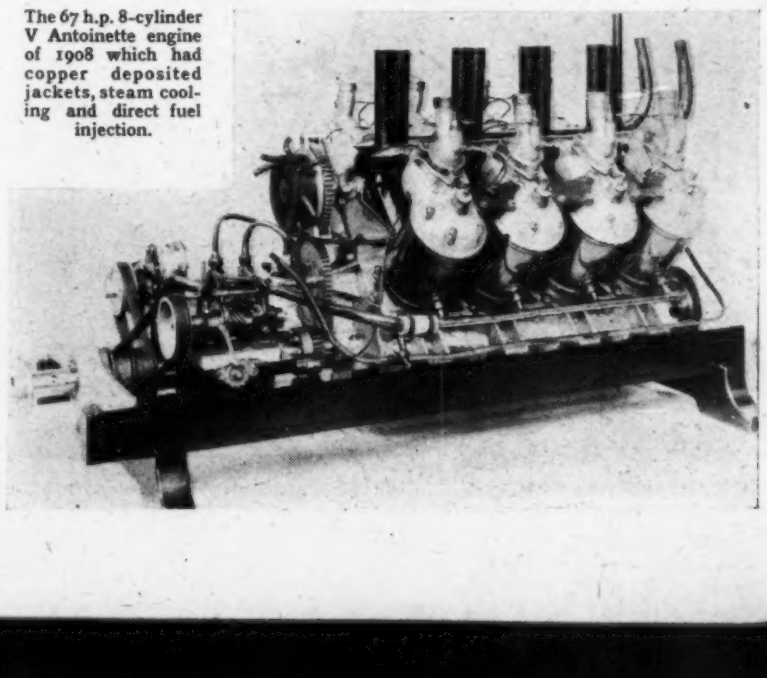
In this paper an endeavour has been made to trace the development of aircraft power plant over a period of 50 years, outlining some of the milestones on the past, and suggesting certain possible lines of development for the future.

Although Langley made his abortive effort with the Manly engine in 1903, and the Wright Brothers their successful flight later that same year, it was not until the now famous series of aircraft race meetings took place in Europe during the years 1908-1910 that substantial engineering firms began to take an interest in aircraft engines. Prior to this date, the initiative had been centred in the small experimenter.

As soon as the internal combustion engine had shown itself to be the only practical prime mover for aircraft, one would naturally have expected to see the large motor car manufacturers become the most important competitors in this new field. The demand for aircraft engines, however, coincided with the first motor car production boom, and in England, with one or two exceptions, and in America exclusively, the industry was too busy to worry about aircraft engines. In France the motor industry, which was virile at that date, was more serious about the matter, and in Germany the automobile companies tackled the problem with enthusiasm; even so, the most successful aircraft engines of the period were produced by specialist firms.

In-line Engines Unpopular

By 1910 a surprisingly large number of firms in Europe were producing aircraft engines, and J. S. Critchley's paper, given before the Institution of Automobile Engineers that same year, includes a list of over 70 different types. Race meetings on small closed circuits, organised by towns as a spectacle, cross-country contests, and Government aircraft-engine competitions became the order of the day, and there was, between 1910 and 1914, a growing interest in engines, chiefly of an amateur and sporting nature, but already with an undercurrent of war potentiality. Little or nothing was known about fuel, except the colour of the cans in which it was sold. Carburation was crude and ignition and plugs bad; hence poor distribution and rough running in the air. Light alloys were in an entirely undeveloped state, and, as airspeeds were low, cooling problems were severe. Owing to the flimsiness of the wooden, wire-braced construction of airframes of that period, the conventional heavy, slow-running, 4- and 6-cylinder-in-line engines were not so popular, since they encouraged vibration in the fuselage and airscrew, and it is not surprising that the smooth-running, air-cooled rotary Gnôme type of engine, with a

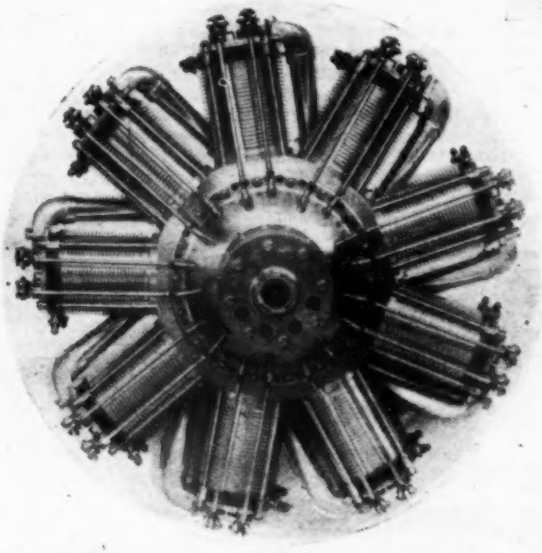


The 67 h.p. 8-cylinder V Antoinette engine of 1908 which had copper deposited jackets, steam cooling and direct fuel injection.

considerable flywheel effect, was most popular with the sporting fraternity and carried off the cream of the races. Accessibility and maintenance were important problems even in those early days, and the air-cooled rotary, although only having a life of about 30 hours between overhauls, gained further kudos as it could readily be dismantled from the airframe, and, owing to its design and construction, could be rapidly overhauled and refitted with certainty in a few hours.

France held a leading position at the outbreak of the 1914-18 war, and although the British Army competition was won by the Green Engine Company, foreign engines were the most popular in this country. The recently established Royal Aircraft Factory having embarked upon their own designs did not tend to encourage matters at home.

I have been fortunate in finding among the archives of the Society a tabulation of the engines



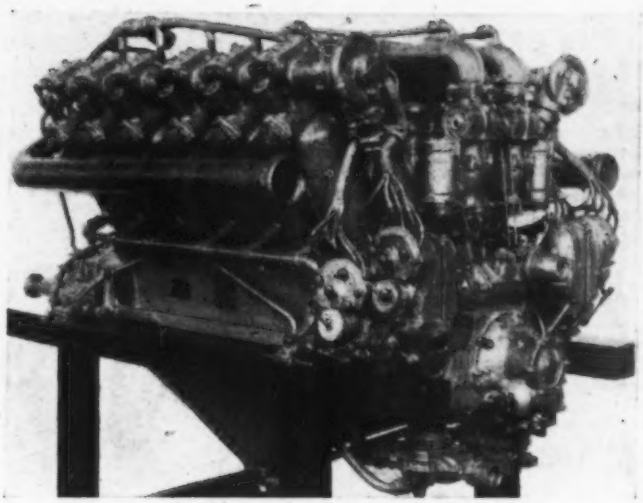
The famous Bentley B.R.2 9-cylinder, air-cooled rotary engine of 240 h.p., which also played a large part in the air war of 1917-18. The low specific weight and short length, giving a low moment of inertia, made it popular for fighters.

used at the Rheims meeting, and I think this is worth showing as it depicts the most popular engines in the first flying race meeting ever held. When one realises the difficulties the designers of these engines were up against, with the poor quality and scarcity of materials from which to choose, the lack of precision machine tools and methods of accurate manufacture and inspection, it is astounding, in my opinion, that they ever achieved the results they did.

Speed of Production

The first period of the last war saw aircraft being used chiefly for scouting and artillery spotting, relying upon engines of about 70 to 120 h.p., and the intensive air war did not develop until the spring of 1916. Time was therefore available for the most important motor car firms in Britain to be drawn into aircraft-engine manufacture.

It is worth mentioning here the speed with which these comparatively simple engines were produced in the last war. The American Liberty is stated to have been designed, made,



The 360 h.p. V-12 Rolls-Royce Eagle engine which was in extensive use during the latter part of the last war. It also had the distinction of being the first engine to cross the Atlantic—on June 14, 1919.

and to have run a 50-hour test, in three months in 1917, and certain new British types were actually designed and put into production in under two years.

In the early stages, the British chiefly used air-cooled rotaries of French origin, air-cooled in-line V engines of Renault or Royal Aircraft Factory origin, or the 120 h.p. Beardmore liquid-cooled in-line engine of Austro-Daimler design.

Initially Germany had a better supply of aircraft engines than we possessed, and in June, 1914, I visited the Mercedes-Daimler works and saw some 40 or 50 six-cylinder liquid-cooled in-line engines all together in one shop, which was a large number in those days. Germany relied upon a range of sound-design, large-volume, slow-running, liquid-cooled engines of six-cylinder in-line type.

Last-War Engine Types

In Britain a variety of new and more powerful engines were developed, and over the most intensive period of the air war we relied chiefly on Rolls-Royce, Wolseley-built Hispano, the Siddeley Puma of 200 to 240 h.p., and the Bentley air-cooled rotary. In France the air-cooled rotaries were increased in power to their limit, and the Hispano was the predominant liquid-cooled engine.

Germany pursued a steady policy of stepping up and increasing her liquid-cooled, in-line, six-cylinder engines to about 300 h.p. America's outstanding effort was the Liberty engine, developed by a group of motor car manufacturers, but technical difficulties delayed the promised schedule from being maintained. A large flow, however, was commencing at the time of the Armistice.

It might be said that during the last war the initiation of the aircraft engine into series production was success

ENGINES AT THE RHEIMS AVIATION MEETING, 1909.

Make	Type	Stated H.P.	Cooling	Number entered	Cylinders	Wgt.	Wt./H.P.	M.E.P.
Wright	Vert.	30	W	7	4	176	6.9	80.5
Antoinette ...	Vee.	24	W	1	8	92	4.8	69.2
" ...	"	50	W	6	8	209	5.2	74.0
R.E.P. ...	Radial	30	A	4	7	150	5.0	73.5
Anzani	"	20	A	3	3	156	7.8	48.3
E.N.V.	Vee.	60	W	2	8	286	5.8	68.3
Gnome	Rotary	34	A	1	5	132	3.3	60.0
Gobron ...	Radial	50/60	W	1	8	330	7.0	56.7/61
Itala	Vert.	50	—	—	—	—	—	—
No name ...	—	50/60	—	12	4/8	—	—	—

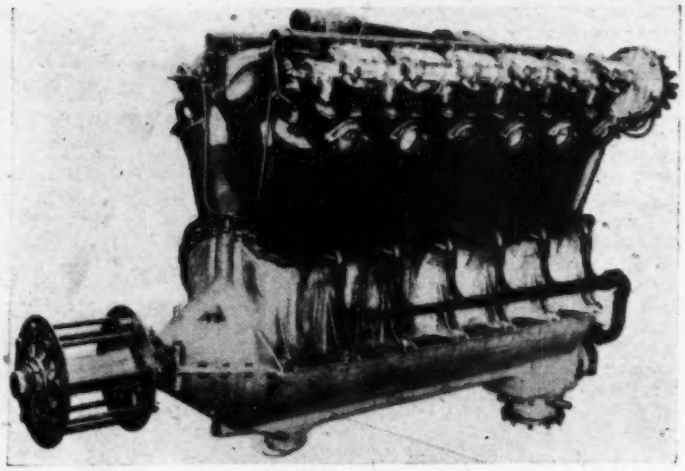
Most notable of the characteristics of these early engines are the low powers and mean effective pressures, and the high specific weight.

POWER PLANT— PAST AND FUTURE

fully realised, and considerable progress was made in the drawing-up of material specifications and standards; in fact, aircraft-engine manufacture grew up from being the specialised province of the experimenter into a national precision industry.

When reviewing the many experimental designs produced later between the two wars it is interesting to recall the project work of the engine design staff at Farnborough, during the years 1914-16, when this Group laid out many new types which eventually saw the light of day in practical form.

The student of history who is interested in the narrative of British power plant should not fail to read Volume VI of "The Official History of the War in the Air," in which the author so frankly discusses the problems of the Air Board in obtaining the requisite number of aircraft engines to meet our needs in various theatres of war; interesting comparisons between the two wars come to light, particularly in regard to putting engines into series production before they are ready.



This engine, the 400 h.p. Liberty, was developed by a group of American motor manufacturers, but was not ready in quantity until the Armistice in 1918.

The end of the last war saw all the major belligerents with firmly established aircraft-engine industries, well-set-up development facilities, and a large production potential due to the fact that the output in engines had increased more than three times over the period of the war.

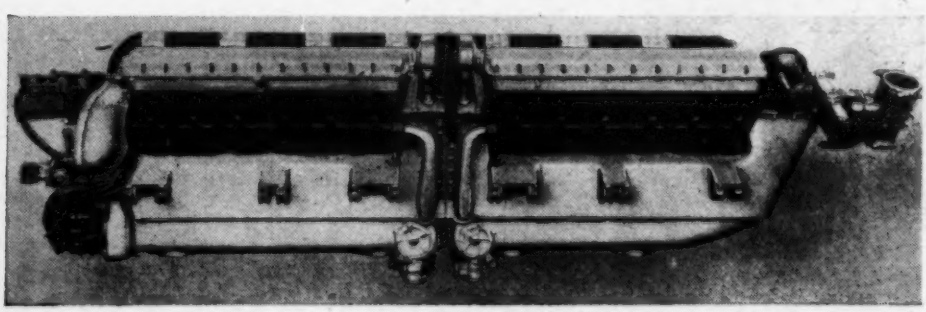
At the end of the war the unfavourable commercial outlook resulting from a general desire for disarmament led the majority of the large industrial undertakings which had entered the wartime production field to revert to their pre-war activities and abandon aircraft-engine work altogether during the period 1919-25. Even so, the few survivors had a hard struggle to keep going in this country.

This was unfortunate for the advancement of technical progress. For instance, the British industry was in a virile state, and a number of interesting large engines of high power were under development during the first few years following the war but were later abandoned. We must take a lesson from this and make sure that the technical development which is in hand to-day, and which is so important to the future of British aviation, does not meet with a similar fate.

The position in France was rather less acute than in this country, for she had not yet fallen on evil days and had a considerable engine production. Italy continued developing engines, while in accordance with the terms of the Peace Treaty, Germany was debarred from making aircraft engines. On the other side of the Atlantic United States manufacturers dropped engine production almost entirely, with the notable exception of the Curtiss Group.

The immortal Rolls-Royce "R" engine developed for the Schneider Trophy contests which it won outright. It developed 2,300 h.p. for a specific weight of 0.71 lb./b.h.p. This figure has never yet been equalled.

The hardest years for the aircraft-engine industry in all countries were between 1919 and 1925, for military requirements were small, and despite a great deal of enthusiastic pioneer work, civil aviation had not assumed sufficiently large proportions to produce any business for the aircraft-engine constructor. By 1926, however, there were signs of a revival of interest in aviation throughout the world, and this helped engine development.



This beautifully clean unit is the 2,800 h.p. Fiat double engine of 1931. It drove contra-rotating airscrews and obtained the world's speed record at that date.

POWER PLANT—PAST AND FUTURE

One of the greatest inspirations to the technical development of aircraft engines, especially in Britain and Italy, was the series of Schneider Trophy races. It would be fair to say that from 1925 onwards the race had a profound effect on the liquid-cooled engine in this country, and several outstanding types were produced.

Despite the success of the liquid-cooled engine in the Schneider Trophy races, however, the popularity of the air-cooled radial was by no means impaired for ordinary civil and service type aircraft, either in this country or abroad. It became, in fact, the general-purpose engine for all American aircraft, being used in all of their Navy fighters, as well as their bombers, and entirely "scooping the pool" for airliners.

Importance of Cowling

Most of the small countries making aircraft engines manufactured air-cooled radials, either of British or American origin; at one time there were 14 different countries manufacturing the Bristol Jupiter engine under licence.

A milestone in the history of air-cooled radial engine development was reached in 1927, when the late Mr. H. Townend discovered that such engines could be greatly improved aerodynamically by enclosing them within a circular cowl. This initial work was taken considerably farther in the wind tunnels of the National Advisory Committee for Aeronautics, and a more advanced technique, which has had a revolutionary effect on air-cooled engine installation, was evolved.

By 1931 the urge for rearmament began to be felt once more throughout the world, and Russia came into the picture with large engine factories, while Germany threw off the shackles of the Versailles Treaty and launched a new programme of engine design and development. Between the early 1930's and the outbreak of the present war, powers steadily advanced to about 1,100 h.p., or some three times as great as in 1918.

It is interesting to reflect that, at the start of the present war, the two basic types in general use were the liquid-cooled V.12 and the air-cooled 9-cylinder radial, both of which were in existence at the end of the last war. No startling developments in layout had, in fact, come to fruition in the twenty years under review, and progress had been rather in the direction of detailed improvements in technique, and the addition of various refinements.

An outstanding development during this period was the introduction of light-alloy monobloc castings with wet liners, and the steady development of air-cooling, but no review of this period can be complete without reference to the development which, more than any other, has enabled the aircraft engine to achieve its outstanding performance, namely, the supercharger.

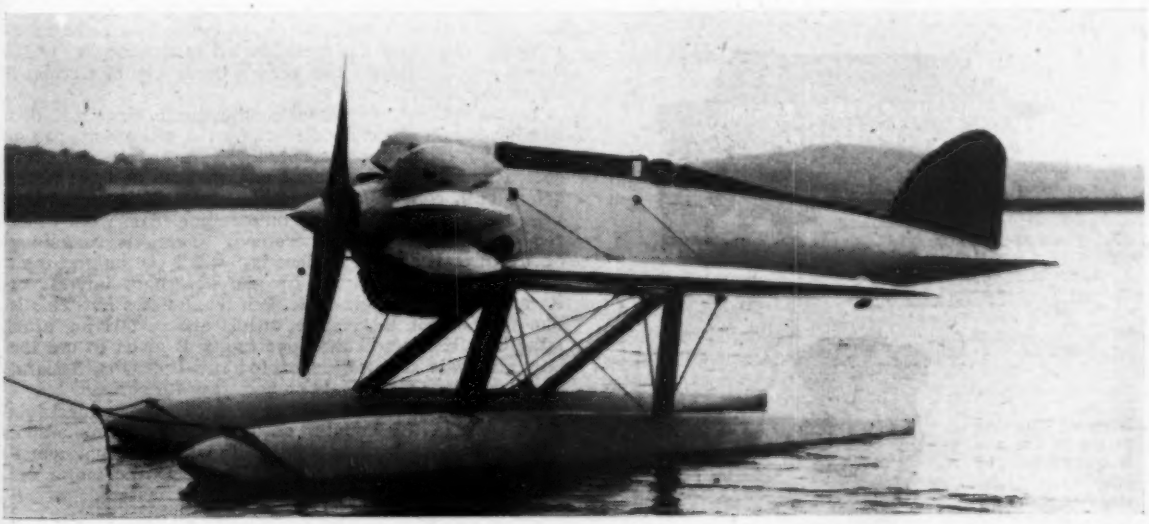
The need for maintenance of power at altitude was fully recognised as far back as 1915, and experiments on the exhaust turbo were initiated at Farnborough, and by Rateau in France, but unfortuntely this method of supercharging was allowed to die away in this country and France in the early '20s, and credit must be given to America, who pertinaciously stuck to this principle and finally evolved the design which has given us the well-known high-altitude bombers of the present war.

To the R.A.E. must be given the credit for the design and initiation of the centrifugal supercharger. A successful design, which became a classic, was actually developed at the end of the last war, and laid the universal foundation for gear-driven superchargers.

Two-stage superchargers did not reach fruition during the period under review, but the special unit of this type produced by the Bristol Company in 1937, with which a world's altitude record was established, will be recalled.

The provision of quickly detachable self-contained power plants had been exercising the minds of designers for many years. Towards the end of 1937 the Air Ministry approached the Society of British Aircraft Constructors and asked them to prepare a scheme whereby engines of similar horse-power, but of different makes, could be interchangeable in certain classes of airframe. A special committee was set up, but it was not found possible to give full effect to its recommendations until after the outbreak of war.

To sum up this very brief review, the interregnum period between the two wars was one during which the emphasis was on major improvements to established basic engine types rather than the introduction of entirely novel layouts, although a great number of different designs were actually built and tried-out in experimental form. The groundwork was laid, however, for a number of important changes which were introduced during this war, and which will receive fuller consideration in the next section.

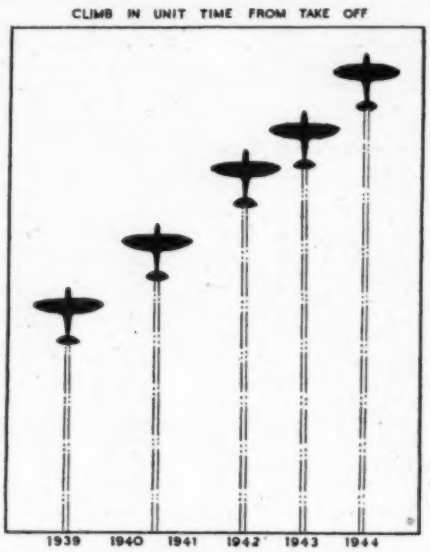


The Short Crusader built for the Schneider Trophy contest of 1927 was fitted with a Bristol air-cooled, 9-cylinder radial engine of 808 h.p. which had a specific weight of 0.85 lb./b.h.p. This engine was the forerunner of the now famous Bristol "Mercury."

POWER PLANT—PAST AND FUTURE

At the present time it is only possible to touch upon a few of the aircraft-engine developments which have been made by the United Nations and the Axis powers since the outbreak of war in 1939. The war started with the belligerent countries having engines of about the same power, viz., 800 to 1,100 h.p., and judging by the tempo of development we shall finish this war with nearly the same step-up in power as occurred in the last war, an average of about three times; this war will probably end with engines of over 2,500 h.p.

When war broke out the psychology and technique of aircraft-engine production were in a more advanced state than those for airframes, and this enabled British aircraft-engine manufacturers to go forward with the scale of wartime production more quickly, and at no time during the war has there been any serious shortage of engines.



Increase in rate of climb of Spitfire resulting from Rolls-Royce Merlin engine development.

Aircraft engine shadow production factories such as those of Bristol and Rolls-Royce in Britain, and of the Wright Aeronautical Corporation in America, have a collection of machine tools, jigs and fixtures of a finer and more comprehensive nature than has ever been collected together before for any one single type of precision series manufacture.

The urge for production has prevented revolutionary developments coming in during this period. The most interesting single problem which has been tackled and standardised is that of the sleeve valve used on the Bristol Hercules and Napier Sabre, both of which have been brought to production fruition during the war, while the most outstanding development of any one particular engine or firm is that of Rolls-Royce on their Merlin, the power of which has been nearly doubled, and the rated altitude nearly trebled. This engine has made a great contribution to the war effort. In the sphere of air-cooled radials, Britain, America and Germany have all made considerable progress.

The outstanding high-power American engine at present in large series production is the 18-cylinder 2,000 h.p. Pratt and Whitney air-cooled radial; it is a highly developed and reliable type, and has built up a most enviable reputation in all theatres of war.

Great credit is due to the Americans for the application of the General Electric exhaust turbo-supercharger to the Fortress and Liberator, as this has enabled their bombers to go regularly over enemy country at altitudes in excess of 25,000ft. Amongst the high-power air-cooled radials of this war, it is considered that the Pratt and Whitney R.2800 and the Bristol Hercules are making the greatest contribution to the war effort.

In the realm of liquid-cooled, in-line engines, the Rolls-Royce Merlin is in a class by itself, and the development of the two-stage mechanically driven blower with intercooler has been an outstanding contribution to the success of our latest fighters.

The Germans attacked the problem of the in-line, liquid-cooled engine with thoroughness, and with the same technique as in the last war, but with a completely different line of approach from that of ourselves. Their Mercedes-Benz DB.601 engine, of 7-litres larger capacity than the Merlin and with low piston speed, gave them an advantage in the early days of the war. This, however, was soon changed by the introduction of improved Merlin blowers, while the latest 2-stage British engine shows a material advantage over the latest German types of even larger swept volume. It is impossible, in fact, to obtain the best performance at high altitude by merely using an oversized engine.

It is considered that the two most important improvements in aircraft-engine component assemblies during the war have been the continual increments in blower efficiency and the introduction of improved fuel-distribution schemes. England has certainly led in the former, while direct petrol injection has been a monopoly of Germany up to the present time.

To the student of internal combustion engineering, this war has seen a stupendous effort by the belligerents in the production on an unprecedented scale of a series of liquid-cooled and air-cooled aircraft engines such as have never before been contemplated. This great achievement has been made possible only by outstanding team work in all the different countries concerned. There is something about aircraft-engine engineering which is unique, and once having been bitten by the absorbing interest of its technique the engineer seldom relinquishes it. This is due to the fact that, since one is always striving after something better and the opportunity is given to use the best materials and workmanship; this breeds enthusiasm and drive, two vital qualities necessary for success.

Be that as it may, there has been the most remarkable team work in this country on aircraft-engine production. During the war this has entailed drawing-in a comprehensive range of productive trades, including the motor car industry and the suppliers of fabricated materials, accessories and precision machine tools, and all have contributed their full share in a most collaborative spirit. The same can be said of the great American industries also. This country can be proud of the effort she has made, and the

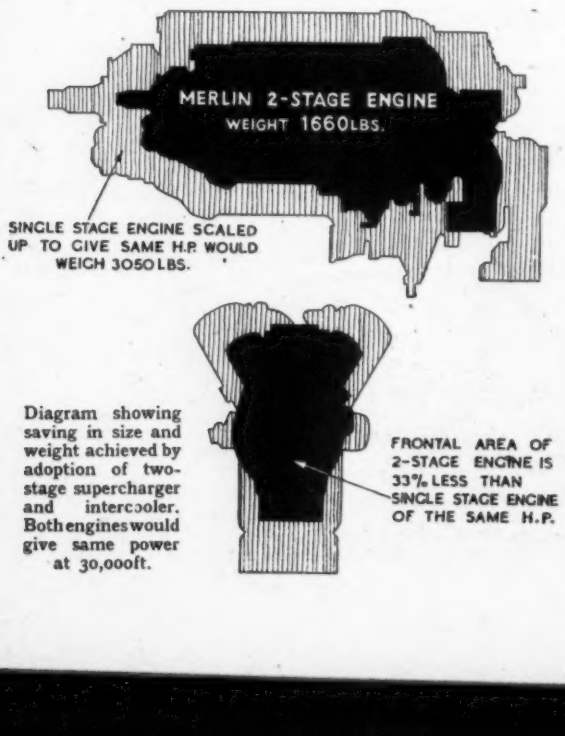

MERLIN 2-STAGE ENGINE
WEIGHT 1660LBS.
SINGLE STAGE ENGINE SCALED UP TO GIVE SAME H.P. WOULD WEIGH 3050 LBS.
FRONTAL AREA OF 2-STAGE ENGINE IS 33% LESS THAN SINGLE STAGE ENGINE OF THE SAME H.P.

Diagram showing saving in size and weight achieved by adoption of two-stage supercharger and intercooler. Both engines would give same power at 30,000ft.

resulting remarkable range of most efficient military engines. From these, and with the experience derived from their design, manufacture and operation, we must be ready after the war, rapidly to build up an even better family of prime movers for civil air transport.

The whole future of the piston engine is closely governed by the quality of the fuels and lubricating oils which may become available in the future, and the history of aircraft engine development would have been very dull, compared with the records of the remarkable achievements actually realised, had it not been for the efforts of the fuel technologists between 1920 and the outbreak of the present war.

At least 15-20 per cent. of the specific power output of front-line aircraft engines realised between the two wars is directly attributable to the improvement in the quality of fuels.

How much longer the demand for specialised research will continue must depend upon the influence of gas-turbine development on the useful life of the reciprocating engine, but so long as there is active competition between the two types of power plant, the petroleum technologists will be pushed harder by the piston engine protagonists, particularly in regard to taking advantage of the possible "Achilles heel" of the turbine, economy in fuel consumption.

Prior to the last war, internal combustion engineers were not fuel conscious. Petrol was specified merely by its specific gravity, and particular brand. During the last war the anti-knock values of the fuels used varied between 50 and 60 octane number, but as a result of the outstanding work of fuel technologists immediately after the war in this country and later in America, combined with the co-operation of the metallurgists and the development engineer, the engines in this war have been provided with a far higher grade of anti-knock fuel. It will be of the utmost importance, if civil aviation is to prosper, that the fuel which represents some 15-20 per cent. of the cost of airline operation, should be supplied at the lowest possible price, and that it should be properly distributed along all the world's commercial air routes.

In view of the well-planned policy of the United Nations there seems no reason to doubt that post-war fuel, which is now termed 100-130 grade, will be available at about 1s. 6d. per gallon excluding duties. We may expect the introduction of much improved fuels such as Triptane for special military purposes. Thus for military and special applications in the civil field, we must encourage still closer collaboration between the petrol industry and aircraft and engine manufacturers. There is, in my opinion, too great a tendency to minimise the importance of fire risk on post-war civil aircraft.

We should give careful consideration to certain of the low volatility blends generally known as safety fuel. It would appear that safety fuels of 100 octane rating could be made available in substantial quantities, after the war, and would largely eliminate the danger of fire.

Whereas considerable progress has been made during the last 20-30 years on fuels, and the technique has advanced whereby an accurate basis has been established for estimating its performance in the engine, the position of lubricating oils is far less satisfactory, and as yet all that is known is that they are composed of a large number of complex hydrocarbons whose exact identification is beyond the capacity of the petroleum technologists.

Matters have not been improved by the British policy over the last 15 years of attempting to employ an oil to a physical specification, to be supplied at the lowest price possible, thus enforcing the running of our highly developed engines on a variable and indifferent quality of oil.

The drive for better lubricating oils in the future is absolutely essential if we are to take full advantage of high-octane fuels and maintain the necessary intensive development on piston engines.

It is reasonable to expect considerable improvements from film strength additives and detergents, and there is considerable scope for the closest collaboration between engine manufacturers and the oil companies. There is no doubt that, given full opportunities, considerably improved results will be obtained, providing longer life of engines between overhaul.

This comprises the first half of Sir Roy's lecture. The remaining sections will be included in next week's issue.

GEN. ARNOLD ON AIRCRAFT LOSSES

GEN. HENRY H. ARNOLD, Commanding General, U.S. Army Air Forces, at a recent War Department Press Conference, disclosed that the A.A.F., in operations against the enemy in all theatres from December 7th, 1941, to May 15th, 1944, had destroyed 16,510 enemy aircraft in aerial combat, probably destroyed 4,650 and damaged 5,546—a total of 26,706.

On the ground, he added, the A.A.F. had destroyed 3,664 enemy aircraft, probably destroyed 347 and damaged 1,432—a total of 5,443. The overall total of enemy aircraft destroyed, probably destroyed and damaged in aerial combat or on the ground was 32,149.

U.S. Army Air Force losses due to enemy action in this period, said Gen. Arnold, total 5,718 combat-type aircraft in aerial combat and 236 on the ground. In addition, he noted, approximately 200 non-combat-type aircraft have been lost due to enemy action in the air or on the ground.

The U.S. Army Air Forces, Gen. Arnold pointed out, flew 746,353 sorties in this period. The tonnage of bombs dropped amounted to 468,391. He also disclosed that 320,489 tons of Japanese shipping had been sunk by the Army Air Forces operating in the Pacific and Asia during the first four months of 1944. He gave the tonnage by months as follows: January, 10,160; February, 159,704; March, 38,450; April, 52,175.

Gen. Arnold said that as the intensity of American bomber attacks increased, the fighter opposition of the *Luftwaffe* has fallen off. When the U.S. Air Forces first went into action over Germany, he said, the enemy fighter opposition was very severe. Since that time the German losses have been so heavy that fighter opposition is now used according to the location and character of the targets attacked.

Gen. Arnold remarked that while it was once customary for the *Luftwaffe* to interpose as many as 400 fighter aircraft in an attack by the A.A.F., seldom do more than 200 fighter aircraft of the enemy now appear in opposition.

"Whereas our force has been greatly increased and continues to increase, the German fighter opposition continues to drop," Gen. Arnold said.

He emphasised that the German problem to-day is to save their fighter force for employment in defence against the expected invasion attacks or to use their available fighter strength to protect the selected targets of Allied bomber assaults. "They cannot do both," he added.

JOURNALISTIC LEND-LEASE

ELSEWHERE in this issue we publish extracts from President Roosevelt's fifteenth report on Lend-Lease, in which he makes handsome acknowledgment of the reciprocal aid given by Great Britain to the United States. With the example of the President of the United States before us, we feel that we cannot do less than acknowledge the aid given by *Flight* to an American contemporary, *Air Tech*.

When the April issue of that journal came to hand, our eye was caught by an article entitled "Fighter Design." It looked very attractive and we began to read. There was something familiar about both the text and the illustrations, although the latter were beautifully reproduced in colour, sometimes in black or blue lines on a white background and sometimes in white lines on blue or brown background.

Suddenly the pieces of the puzzle clicked together. In *Flight* of January 28th, 1943, we published an article by our Editor under the same title. The drawings in our contemporary had been printed in colour or "reversed" and half-tone blocks of the different types of fighter added, but they were undoubtedly our drawings. A closer study of the text revealed that it had been slightly paraphrased here and there, although many passages were quoted verbatim.

An examination of the title-page disclosed the fact that the "author" is Associate Editor of our contemporary. Since he did not see fit to acknowledge *Flight* in any way, we have much pleasure in doing so. We are happy to think that we have contributed, in our small way, a little bit of Lend-Lease in Reverse.

Indicator Discusses Topics of the Day

Approach Attitudes

— and the Effects of the Modern Technique on Landing Characteristics: The Need for Greater Clarification During Advanced Training: "Mushing" Manners and Methods: Unqualified Variations

DESPITE all that was said in these columns a few weeks ago about "learning to walk before we can run" where really big aircraft are concerned, it *is* an interesting fact that pilots very quickly fall into the way of things when new and faster types are produced, each with special characteristics of its own. And for that we have, in large measure, to thank the designers. If any one of these present-day aircraft—with landing speeds well over the hundred mark, and approach speeds of the order of airline block-to-block averages of the year 1938—suffered bad and difficult habits near the stall it would indeed be a very different story.

There is nothing intrinsically more difficult about judging an approach at 150 m.p.h. and a landing at 115 m.p.h., than there is in approach and landing judgment at half these speeds. Always provided there is enough room to allow for the slight variations in technique—variations which only made a difference of 50 yards in the old days, but alter the run by anything up to 300 yards now. Given adequate space and good characteristics, a 115 m.p.h. landing presents no particular difficulties—it is merely that any accident is more than proportionately serious. The mildest swing removes the underparts if it is not checked in good time; and uncorrected overshoot generally means a write-off; and the failure either of the flap operating gear or the brakes usually involves a belly landing if no two-mile runways are available in the vicinity. Pilots must be more careful and more carefully trained, so that the now greatly exaggerated errors are the exception rather than the rule.

There is, however, one characteristic common to many modern types which is not, I feel, sufficiently well explained or understood by instructors and experienced pilots respectively. This is the vital importance of *attitude* during the last part of the approach and, to a less important degree, during the take-off and initial climb.

Old-time Attitudes

In the old days any aircraft would take up a fore-and-aft attitude in almost direct relation to the speed of approach or climb. One was given a "best" climbing speed and a "safe" approach speed, and everything went according to plan if one stuck, within reasonable limits, to these figures. Later on, as the pilot got to know his aircraft, he could invent his own variations—but these variations always involved a change of speed as well as of attitude.

Now, with certain wing sections, high loadings, and the customary rumble approach, there is a rather different story to tell. Anywhere within 30 m.p.h. or even more, of the actual stall during a motoring approach, there seems to be little connection between speed and fore-and-aft attitude, whether the flaps are up or down. This "sinking" or "mushing" peculiarity is more pronounced on aircraft fitted with camber-changing rather than with split-type flaps, but I noticed it first in two highly loaded types which were each fitted with split flaps. In each case I found that from exactly the same approach speeds and in the same weather conditions the landing could be either normally "floaty" or straight off the approach and somewhat heavy. The air-speed indicators were checked and found to be correct, so I put the trouble down partly to poor handling on my part, and partly to the probability that the aircraft had, unknown to me, greater all-up weights. One aircraft was a fairly unconventional fighter of which I expected to see no more, and the other was a really big affair with which I made a mental note to use more power during the last stages of the approach and otherwise forgot all about it.

Although I have only realised it since (while flying two types of aircraft having this "mushing" characteristic to a pronounced degree) the fact was that in each of the landings I had allowed the aircraft to sink into the ground—the final checking motion on the control column merely aggravating the effect and producing a "G" stall at a speed still higher than that at which the type normally lost its capacity for flying. Incidentally, the "mushed" landing must not be confused with the heavy landing—sometimes on three points—caused by checking too violently at the last moment. Any modern aircraft with a reasonably high wing-loading and good slow-speed elevator control can be given a momentarily higher stalling speed by over-zealous checking and a consequent temporary increase in wing-loading. The effect is merely a minor example of the sort of results obtained by any ham-fisted aerobatic pilot who, even with a fairly good aircraft, will flick off the top of a loop or spin off a tight turn at quite astonishingly high indicated airspeeds.

Engine On and Off

Since the aerodynamic experts will tell me that, whatever the loading and wing section, there *must* be a connection between speed and attitude, I will forestall them by giving the probable explanation. Every high-efficiency aircraft must, to some degree, be brought in under power, and the use of engine upsets all the calculations, because in any aircraft which has a pronounced natural sink at low speeds a very wide choice of attitudes is possible while holding the same speed and the same approach line, but while, perhaps quite innocently, using different boosts.

Let us say that one's recommended approach speed with a particular type is 130 m.p.h. and that the stalling speed is 115 m.p.h.: the aircraft can be brought in with a whiff of throttle and with the tail up, or, at the other extreme, with the tail well down and enough power to deal with the necessarily increased drag at this attitude and to counteract the incipient sink. We will now imagine that two pilots cut their throttles as they cross the boundary. Provided that the pilot doesn't check too violently, the aircraft in the first case will take some time to float off the excess 15 m.p.h. because it is in a level low-resistance attitude. In the second case, however, the aircraft is being dragged along by the engines tail-down, and when the motor assistance is no longer there it will lose that 15 m.p.h. very rapidly indeed and will, in the words of the pilot, "fall out of his hands" straight off the approach.

So we have two pilots, perhaps, arguing about approach speeds and results, but each innocently using a different degree of throttle opening during the vital part of the approach. One of them will say that he comes in at 120 m.p.h. and yet floats half down the runway; and the other will say that he comes in at 140 m.p.h. yet touches down beside the chequered box every time. Each makes his final turn at the same height and in the same position relative to the boundary and each is telling the truth about the aircraft, which may be as alike as two peas. But, while one may be using zero boost during the first part of his straight approach, the other is using a figure off the clock, and the two aircraft cross the boundary in totally different attitudes—one ready to land and the other with the tail still well up.

Except in the case of engine-failure with a twin, initial climb attitudes are not so often discussed, but the story

APPROACH ATTITUDES

is still the same. An aircraft leaving the ground tail-down will neither climb nor gain speed as quickly as one with its tail well up, and, because of its greater drag, the former's run may even be longer, though it will fly, prematurely, at a slightly lower air speed—and practically guarantee a stall if the engine so much as coughs!

Well, there it is, and I am more than happy to pass the problem on to those who are better able to explain exactly what is actually happening. One of these days I shall go in for the good old-fashioned system of gumming tufts of wool all over the wing and watching them while making approaches at different throttle-openings and attitudes. Maybe, after seeing the tufts all sitting bolt upright at a speed some 20 m.p.h. in excess of the stall, I shall realise that it is not a good thing to know too much about what is actually going on. It is a never-ending source of amazement to me that an aircraft will stay in the sky with no visible means of support, while the spirit of the Wright Brothers wrestles with that of our old friend Isaac Newton.

"INDICATOR."

Reverse Lend-Lease

IN his fifteenth report on Lend-Lease, President Roosevelt gives an account of the reciprocal aid which the U.S. has received from Great Britain and makes handsome acknowledgment of the fact that even the high monetary value of actual material supplies does not represent the full extent of aid given. He points out that the achievements of the British fighting man, and the information based on war experience and passed on to them are forms of aid which cannot be, and are not, given a financial value.

A great proportion of the purely material aid has been to the Eighth and Ninth Air Forces; the text of this part of the report is as follows:—

"By the first of this year the dollar value of goods, services, and facilities provided by the United Kingdom to army, navy and air forces and to our merchant marine totalled $1,526,170,000. These figures do not reflect the value of the vital information on military equipment freely turned over to us by the British, who had over two years of battle experience before we entered the war. No financial valuation can be placed on this type of aid.

"Not counting construction materials, reverse Lend-Lease supplies provided on the spot in Britain already amounted to about 3,000,000 ship-tons by January 1, 1944.

"One-third of all the supplies and equipment currently required for our very great forces in the United Kingdom are provided by the United Kingdom and are provided as reverse Lend-Lease, without payment by us. The cost of this aid to the United Kingdom, including shipping, averaged about $90,000,000 a month in the last three months of 1943. The 8th and 9th Air Forces have received reverse Lend-Lease aid particularly vital to the success of their operations. Following is a list of a few of the many thousands of different types of reverse Lend-Lease supplies, equipment, and services, as reported by our Air Forces up to the end of 1943 which gives some indication of the extent and variety of this aid:

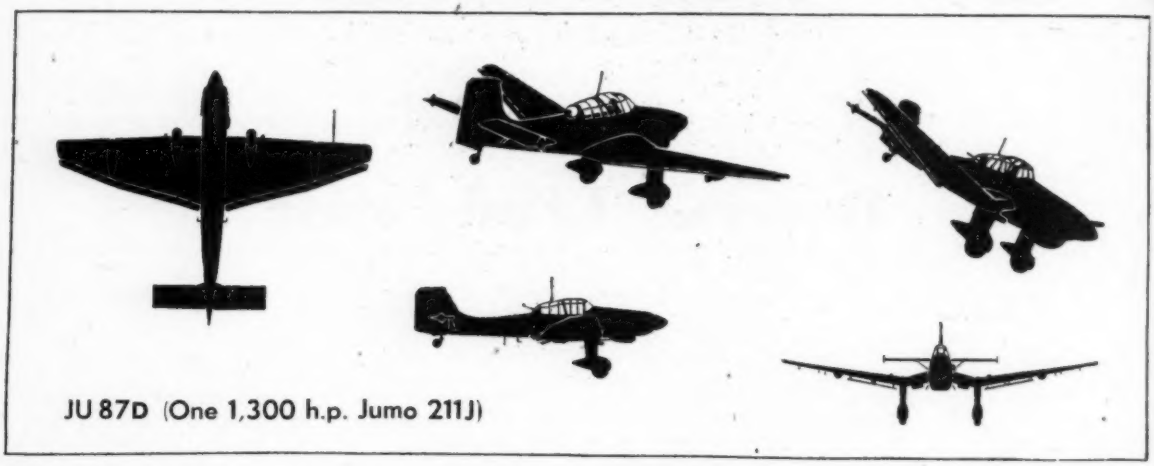
"Bomber and fighter airfields and air bases; advanced airports, combat crew replacement centres, barracks, repair depots, warehouses and storage facilities, etc., which cost the British $355,000,000 to the end of 1943 to build and equip for the U.S. Ten thousand civilian employees with an annual pay roll of $12,000,000 have been employed on the construction programme for forces, principally on airfields and air bases. 452,000 tons of equipment and supplies have been furnished.

"Included among the items of aid are the following:—1,100 Spitfires and other aircraft, 1,357,000 sq. ft. of steel and light alloy sheets for repair and adaptions needs in our aircraft depots, 235,000 synthetic rubber shock absorbers, 32,000 bombs of various sizes, 7,000 sets of armour plant for heavy bombers, 5,000 collapsible rubber dinghies, 10,600 aircraft tyres, 35,000 108-gallon belly tanks for fighter aircraft, 9,600 pieces of protective body armour, 9,300 bullet-proof glass panels for aircraft, 43,000 easily jettisoned lightweigh gas tanks for long-range fighters, 43,000 electrically heated muffs for gunners, 2,000 parachutes, 1,750,000 pairs of socks, 1,500,000 pairs of knitted woollen gloves and substantial quantities of other types of clothing, 44,500,000 yards of Sommerfeld track, 60,000 aircraft, warship and armed vehicle recognition devices, all requirements for aircraft engine spark plugs, twelve factories working solely on production of transformers for U.S. Air Forces, 50 mobile repair shops for the repair of American bombers forced to make crash landings in the United Kingdom, 625 British type fighter gun sights, special photographic equipment (for one out of each three aircraft in bomber squadrons to take pictures of the target during the bomb run), large quantities of specially heated winter flying clothing, and various types of specialised radio equipment."

ATLANTIC RECORD BREAKER: The Canadian-built D.H. Mosquito, which recently made a coast-to-coast transatlantic record in 5 hr. 40 min., on show at one of the De Havilland plants in Britain. Piloted by Wing Cdr. John Wooldridge and navigated by F/O C. J. Bown, the 2,200 miles from take-off to landing was covered in 6 hr. 40 min.

Studies in Recognition

Aircraft in Fi

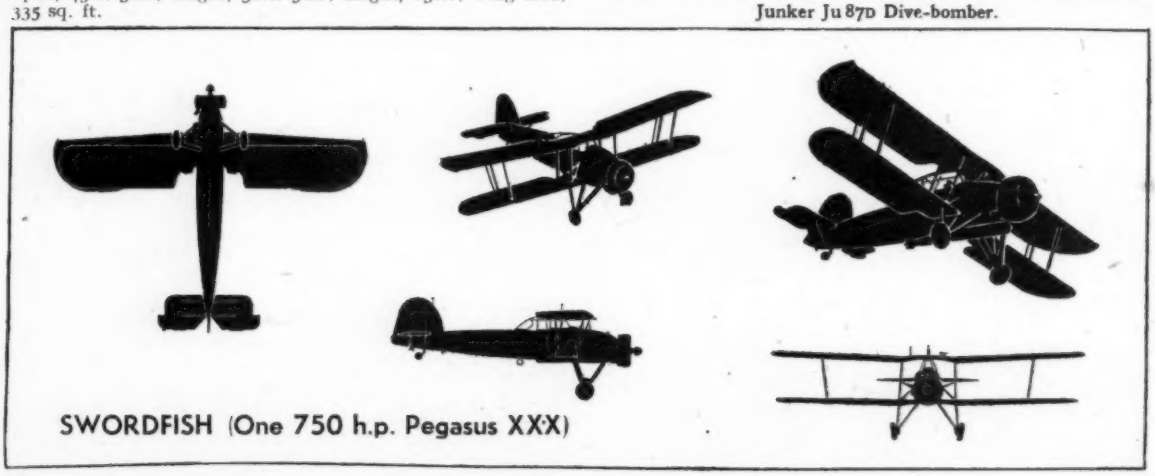


JU 87D (One 1,300 h.p. Jumo 211J)

HISTORY will probably record that it was the Junkers Ju 87 which first showed a bewildered world what dive-bombing could mean as practised by the Nazis. At the outbreak of war the Stuka had no effective opposition and its military objectives included refugees. The Ju 87D is a cleaned-up version basically the same as the original and now only used where Allied fighters are not expected to be met. It has a Jumo 211J engine of 1,300 h.p. and a top speed of 255 m.p.h. Armament comprises two 7.9 mm. machine guns in the wings and two more in the rear cockpit. Bomb load is 4,000 lb.

Recognition points include cranked wings tapering to small square tips, rectangular strut-braced tailplane, large angular fin and rudder, and fixed spatted undercarriage. Dimensions: Span, 45ft. 3in.; length, 36ft. 5in.; height, 13ft.; wing area, 335 sq. ft.

Junker Ju 87D Dive-bomber.



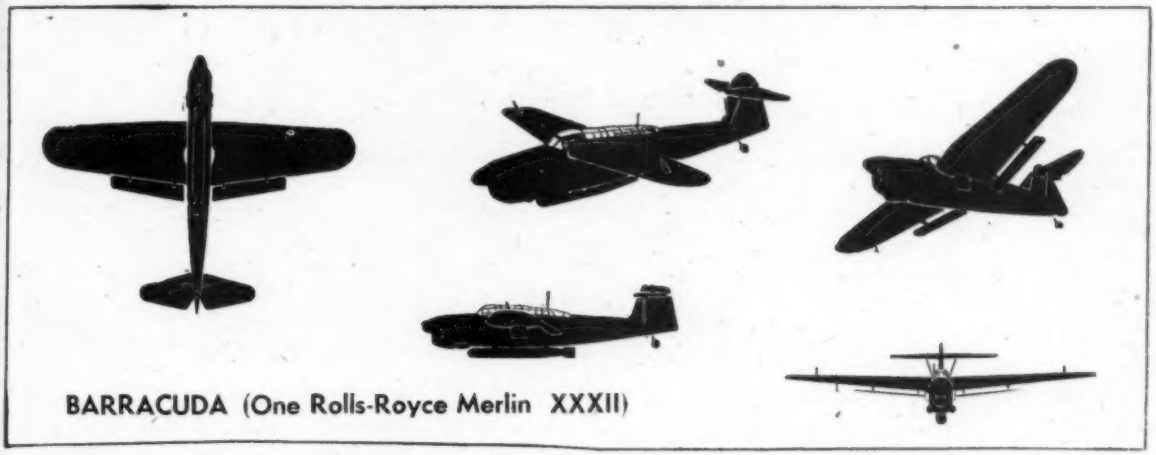
SWORDFISH (One 750 h.p. Pegasus XXX)

Fa'rey Swordfish Torpedo-bomber.

ALTHOUGH well advanced in obsolescence, the Fairey Swordfish is still in service and is well liked by Fleet Air Arm pilots, particularly in very bad weather. Powered by a 750 h.p. Bristol Pegasus XXX, its top speed with torpedo or 1,500 lb. bomb load is only 138 m.p.h., and this is reduced to 128 m.p.h. in the floatplane version. Equipped for reconnaissance only, its speeds are 144 and 134 m.p.h. respectively. Armament is limited to two 0.303in. machine guns.

A two-bay, staggered biplane of unequal span, the top wing only is backswept, there are projecting horn-balances on the elevators of the angular, untapered strut-braced tailplane, the single fin and rudder is large and rounded, and the fixed undercarriage is unfaired. Originally the tandem cockpits were open, but versions with enclosed cockpits are now also in service. Dimensions: Span, 45ft. 6in.; length, 35ft. 8in.; height, 12ft. 4in.; wing area, 549 sq. ft.

ing Attitudes



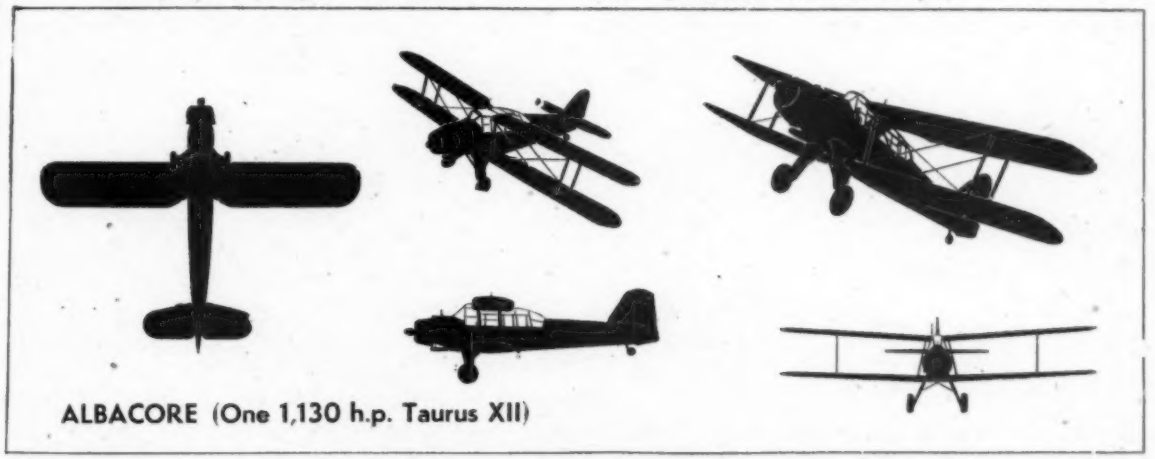
BARRACUDA (One Rolls-Royce Merlin XXXII)

Fairey Barracuda Torpedo-dive-bomber.

THE Fleet Air Arm's most up-to-date acquisition, the Fairey Barracuda recently made a triumphant public debut by its devastating bombing attack on the *Tirpitz* in Alten Fjord, thus confounding parliamentary and other ill-informed criticism levelled in advance of any practical demonstration.

Admittedly the Barracuda is not the most sleek of aircraft, but the operational requirements to be met in a modern T.B.R. type are a designer's nightmare; compromise is inevitable.

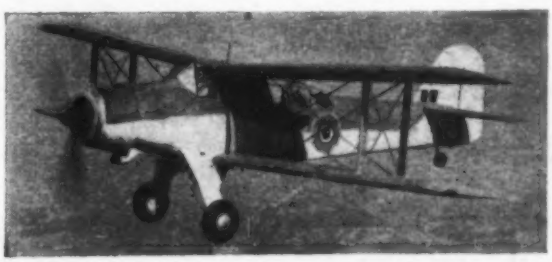
Powered by a Rolls-Royce Merlin XXXII giving high power for take-off and at low altitudes, with high rate of climb, the defensive armament is manually operated and mounted in the rear cockpit. Recognition is made very easy by virtue of the shoulder wing with projecting flaps, and the tapered strut-braced tailplane set very high on the broad fin. A streamlined "glasshouse" covers the cockpits.



ALBACORE (One 1,130 h.p. Taurus XII)

INTENDED as an interim replacement type for the Swordfish, the Fairey Albacore was the last of the naval biplanes. It is larger and aerodynamically cleaner than the faithful "Stringbag" and some 25 m.p.h. faster. Like its predecessor it is still on the active list. A 1,130 h.p. Bristol Taurus XII sleeve-valve engine provides the power, and top speed is 161 m.p.h. with torpedo or 2,000 lb. bomb load, and 169 m.p.h. in reconnaissance trim. Armament consists of two Vickers 0.303in. retractable machine guns in the rear cockpit.

Recognition features include single-bay, equal span, unstaggered wings, cantilever tailplane with rounded tips, large single fin and rudder with broad round apex, and fixed, faired undercarriage, but no spats. Pilot sits in front of leading edge; tandem cockpits enclosed. Dimensions: Span, 50ft.; length, 39ft. 10in.; height, 14ft. 9in.; wing area, 623 sq. ft.



Fairey Albacore Torpedo-bomber.

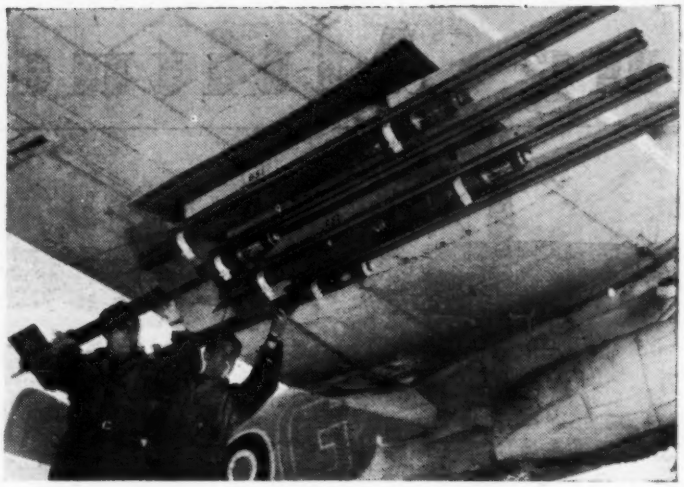
Rocket Projectiles

Russian Anti-tank Weapons Developed by Allies for Use Against Shipping Targets

ROCKET projectiles fired from under the wings of low-flying aircraft were one of the biggest surprises the Russians had up their sleeve for the Germans. The idea has been developed by us and used on Coastal Command aircraft. Hurricanes, Beaufighters, Typhoons and Swordfish are all adapted for their use and four rockets are carried on guide rails beneath each wing. As will be seen by comparing the size of the projectile to the chord of the Beaufighter wing the complete rocket is some six feet in length.

Apart from the head the projectile consists of a tube filled with cordite. When fired, the cordite is ignited by a small platinum fuse and the flow of gas propels the rocket. Although, of course, the crew on the firing aircraft are unable to hear anything of the passage of the rocket, to observers on the ground it sounds just like a continuous peal of thunder. Cruciform fins are fitted at the rear end to ensure stability. The pilot can select pairs for discharging, one from under each wing of course, or, if the target justifies it, the whole eight can be fired at once. Although a salvo of eight is comparable to the broadside of a light cruiser, the aircraft feels no shock because the rockets are self-propelled and, therefore, there is no recoil.

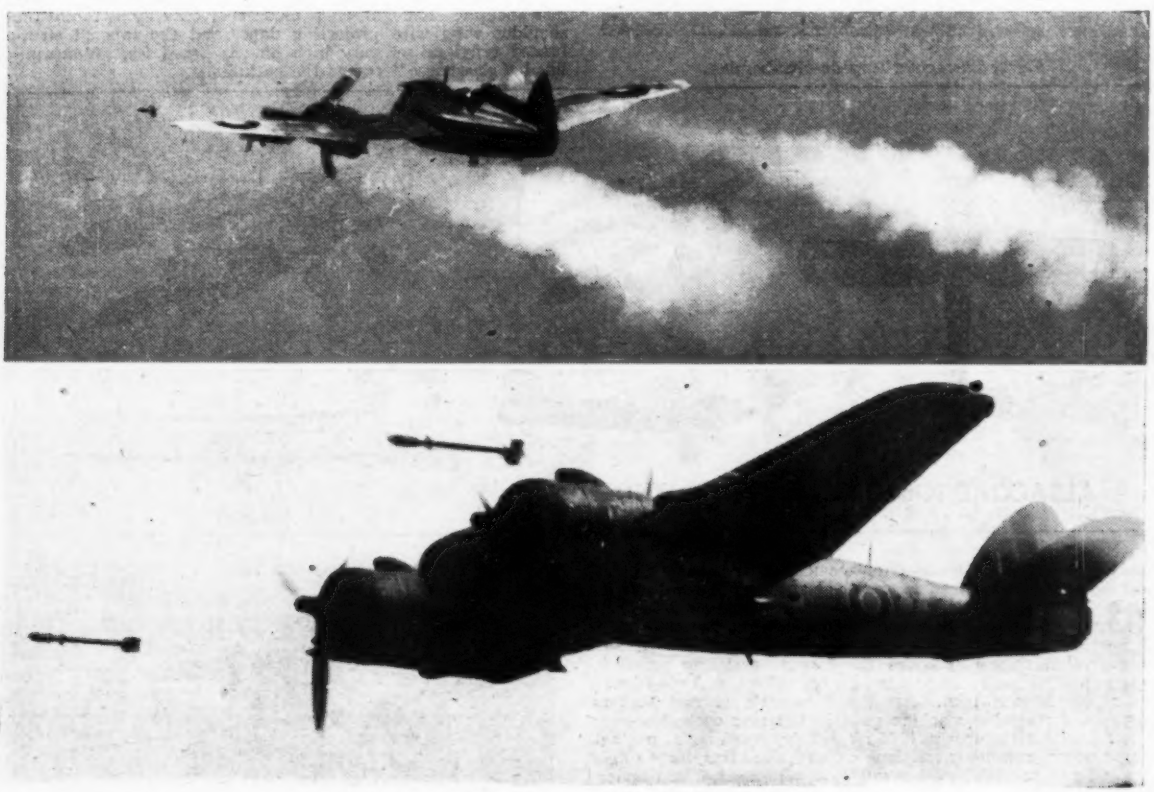
R.P., as it is known in the service, is used by Coastal Command for two purposes, either as the main weapon against shallow draught ships or as an anti-flak weapon to upset the A.A. gunners while the torpedo aircraft make their runs.



Loading rockets into the guide rails of a Beaufighter. The great advantage of the rocket projectile is that, since it carries its own power plant, there is no recoil on the aircraft which, therefore, does not drop its nose.

In addition to anti-shipping strikes the R.A.F. are using the new weapon in low-level attacks against land targets such as bridges, gun emplacements, wireless stations and military buildings.

A very good example of the last-named type of target was a German military headquarters in a building in Northern France. On Whit Sunday the Second Tactical Air Force detailed a number of rocket-projectile Typhoons to "remove" this building. So successful were the attacks by the first aircraft that little was left standing for later arrivals to attack. On the same day other rocket-firing Typhoons successfully attacked an electrical plant near Hardelot. The "Brock's Benefit" is said to have been worth watching, the blue flashes from the high-tension shorts mingling with the smoke.



Two views of a Beaufighter discharging pairs of rockets. Four rockets are carried under each wing, and can be fired either in pairs or all together. The salvo of eight is equivalent to the broadside of a light cruiser.

Britain's Overseas Air Services

Transport Command and B.O.A.C. Provide the Basis of Vast Post-war Expansion : Some Regional Plans and Possibilities

B.O.A.C. PRE-WAR AIR ROUTES

By EDWARD C. BOWYER

STATISTICS recently released for publication have revealed something of the magnitude of the organisation which it was my privilege to glimpse during my tour of Transport Command and British Overseas Airways routes overseas.

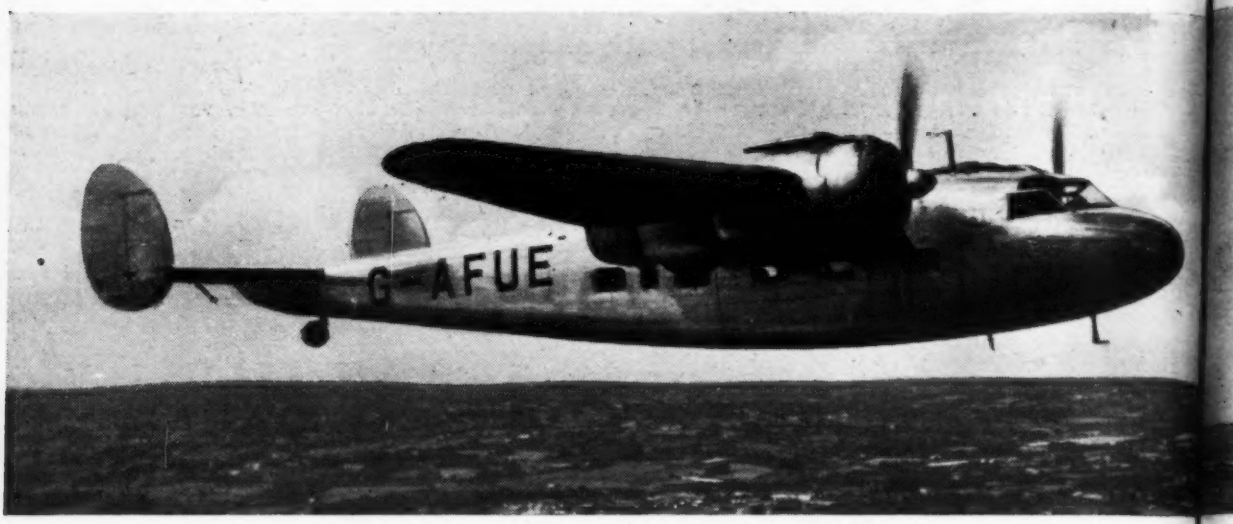
Scheduled services of this great network of British wartime airways abroad cover an aggregate distance of 85,000 route-miles. Every month the air transport fleets fly more than three million miles. Freight carried in a period of a little more than nine months totalled more than 2,000 short tons; in kind, it was most diverse, including aircraft spares, radio equipment, medical stores such as "iron lungs" and blood plasma, small arms and ammunition, tyres, and a thousand other items needed for maintenance of air and ground forces at advanced posts in distant theatres of war.

Information given me on my journey indicated clearly that these impressive figures are now greatly exceeded, and that the curves of traffic tonnage and volume are climbing steeply to peaks unheard of in air transport before the war. In one month early this year, one Group of Transport Command alone carried 1,750 passengers, 40 tons of mail and more than 200 tons of freight.

Transport Command is, of course, much more than an operator of trunk and feeder air line services. It is engaged also in the reinforcement of operational squadrons in the field, and the ferrying of aircraft from America and Great Britain to the various battlefronts. Further, Command units do much operational transport flying with the Forces in actual battle campaigns. Reinforcement and ferrying between them account for more than 1½ million miles of flying every month, most of it over the Atlantic Ocean. Mobile advanced units have evacuated many thousands of casualties by air from Sicily and Italy to base hospitals.

Here, then, is the wide and sturdy base for the post-war air services which will be operated by Great Britain and her sisters in the Commonwealth. International policy will decide the shape of many things to come in world aviation. Atlantic services and the main intercontinental routes may be the sport of statesmen, and cards in the great game of world politics after the war. Forecasts of the future of such routes are difficult indeed, and obscured by present lack of knowledge of the overriding demands of post-war world security. But in large regions already served by Transport Command and British Overseas Airways there is room for substantial development of air transport under the aegis of regional governments and by regional arrangement.

The D.C.3 which, for size and payload, the author considers to represent a type basically suitable for air lines in India.



In the Flamingo (Bristol Perseus engines) the De Havilland company already have an aircraft eminently suitable for post-war use.

BRITAIN'S OVERSEAS AIR SERVICES (CONT.)

While, therefore, no tour of present routes can throw much light on the transocean and intercontinental possibilities, there is a great deal which may be learned of more local prospects, and it is to some of them that this second article in the present series is devoted.

I had the rare opportunity of discussing post-war plans in several important regions with the men who have been most intimately associated with their consideration, and with business men and transport operators who have concrete ideas for post-war enterprise in the new field of transport. Everywhere I found a measured confidence in the future—far removed, perhaps, from the rosier dreams of the enthusiasts, but nevertheless indicating the settled conviction that air transport has a great part to play in the progress of vast communities. In its way, the sober and considered judgment of civil servants and industrialists was more heartening than the dreams; it depicted with utter certainty a minimum of advance, and did not rule out a larger achievement.

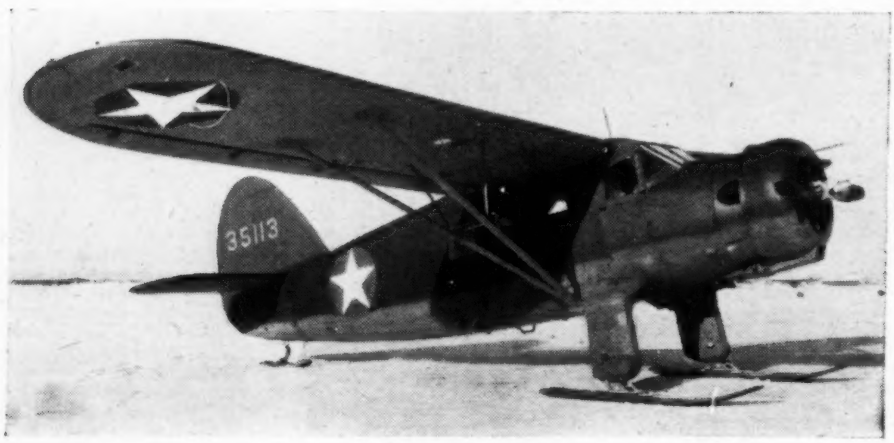
First among the regions which arose for discussion in the course of my journey is the Indian Empire, where I made my first halt of any length and where I was able to discuss post-war plans and possibilities with leading industrialists and, on the governmental side, in particular with Sir Frederick Tymms.

Perhaps the first factor to be taken into account when assessing the potential field of air transport in India is the poverty of the immense population. Ten times as many human beings live in the Empire as in Great Britain, but the aggregate income—I was informed—is only one-tenth that of this country. The "poverty factor" relative to Great Britain is, therefore, as 100 to 1. Here is the main reason for the comparative lack of development of air transport in India up to the war. I heard the estimate that at least 95 per cent. of the population can have no possible interest in aviation, other than to look up idly from the streets and fields as an aircraft flies past.

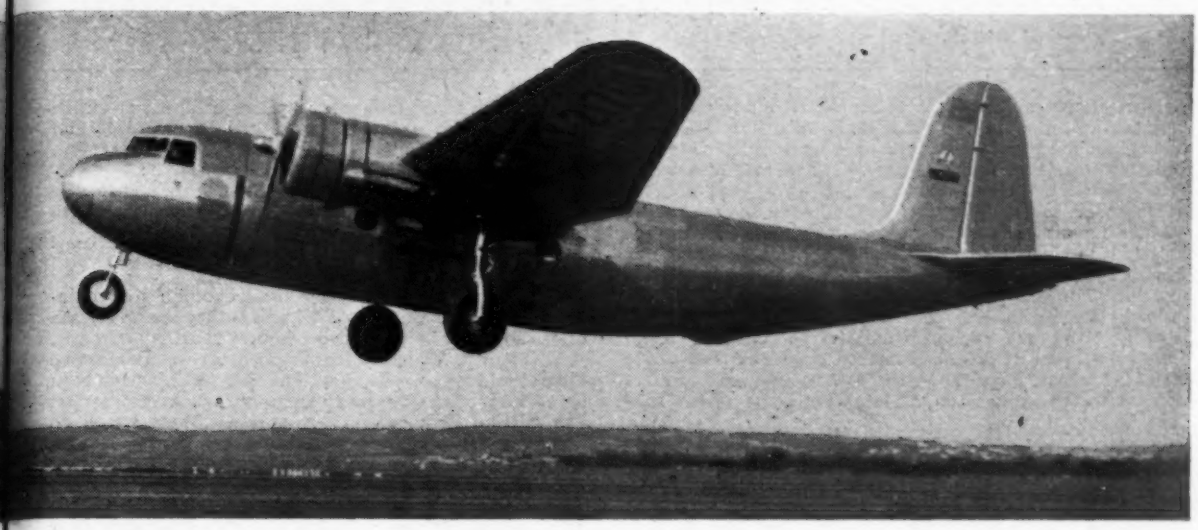
Plainly, a perceptible rise in the standard of living would lead to much greater use of air and other forms of communication than at present appears possible. That possibility is undoubtedly in the back of the minds of the men concerned in studying the future of India, but it has not influenced the Empire's present plans for post-war flying.

Favouring the immediate development of air transport are two main factors—the big demand among merchants and industrialists for such development, and improved finances. India, in contrast to her pre-war state, now owns large Sterling balances, and her post-war financial position should be altogether easier. For the first time, the Indian government is able to contemplate sizeable expenditure on development projects.

Indian civil aviation will have at its disposal much of the work which has been done in furtherance of war needs. Many new and modern airfields have been laid down. Runways of 2,000 yards and more in length are to be found at several airports, including some whose names are yet un-



Canadian climatic conditions and requirements are met to some extent in the Noorduyn Norseman. This eight seater can be fitted with either float, wheel or ski undercarriages.



The Douglas DC-5 was designed and built just prior to the war in direct competition with the D.H. Flamingo. Alternative accommodation caters for 16 to 22 passengers.

known but which daily clear a larger number of aircraft than most of the main European terminals before the war. Existing airfields have been improved, their runways and hangars extended, their navigational and weather equipment greatly augmented, and facilities for repair and maintenance provided. There are to-day large factories in India where Service aircraft and engines are repaired and overhauled. They employ, in addition to white labour, some tens of thousands of Indian operatives, who have been trained to a reasonable level of efficiency.

Many aircraft components, including tyres, parachutes, airscrews, are made nowadays in Indian factories. Plans are going forward for production of special steels and plastic materials and articles. Clearly, at the end of the war India will have in working order most at least—and probably all—of the essential requirements of modern air services.

Indian Facts and Figures

At present two Indian companies are predominant—Tata Air Lines and Indian National Airways. Many other interests would like to enter the field. There is scope for enterprise. And Indian ground and flying personnel, with a minimum of experienced white supervision in the early days, has already proved its ability to operate efficient, safe and regular air services. No air line company in the world would be ashamed of the record established by Tata Air Lines—incidentally, just one offshoot of the greatest industrial enterprise in India and the personal care of the Tata chairman, Mr. J. R. D. Tata, whom many consider India's greatest industrialist. Operating routes over Karachi-Colombo (1,900 miles), Bombay-Trivandrum (780 miles) and Bombay-Delhi (800 miles), Tata Air Lines have maintained, since the company was formed in 1932, an average regularity of no less than 99.4 per cent. over an aggregate route mileage of 3,600. Their flying and engineering personnel are almost entirely Indian.

My expectation is definitely that Tata—and other Indian business concerns—will be deeply interested in air transport after the war. A similar view is no doubt held by the authors of the "five-year plan" for Indian air transport, recently submitted by the Posts and Air Department for consideration by the central government. The proposed routes, including those already in existence and those projected, cover a main trunk mileage inside India, with connections to Kabul, Colombo and Rangoon, extending over 10,500 miles. A daily service over this network would mean 7½ million miles' flying a year—approximately five times the pre-war aggregate.

The "average" main-line aircraft envisaged is roughly the size and payload capacity (say, 5,000-6,000 lb.) of the DC-3. This does not mean that the whole plan depends on the use of DC-3 aircraft; the authors are thinking rather of an improved version of present-day 30,000-35,000 lb. twin-engined aircraft. Such aircraft, to be successful in India, must in view of the Empire's "poverty factor," be exceptionally efficient as measured in cost per ton/mile.

Routes on which traffic is not yet fully built up could profitably use aircraft of smaller carrying capacity and less all-up

Luxury, long-range and short-haul work were all possible alternatives in the Flamingo cabin layouts. For airline work any number of seats between 12 and 20 can be fitted.

BRITAIN'S OVERSEAS AIR SERVICES

weight. Economy in operation, simplicity in servicing and maintenance, low ton/miles per gallon of fuel—these and other fundamental criteria are even more important in India than in some other regions. (There will also be a field for small feeder and charter aircraft—say, 5 to 8-seaters of reasonably low first cost and economical to operate.)

Main line air fares may be pegged at about 3 annas per mile, which compares with first-class railway fares ranging from 1.85 to 2.45 annas. All who have experienced the discomfort of long-distance rail journeys inside India will probably agree without further argument that the extra cost is well worth while, without counting the saving in time. Employing aircraft of the class contemplated, the total transport effected on the main Indian network would amount to 12½ million ton/miles a year—or 15 times the pre-war annual average.

Capital cost of the fleet required to run the essential services is estimated at 150 lakhs of rupees (approximately, £1,125,000). Annual cost of operation is estimated at Rs.2.53 crores (say, £1,900,000), falling to Rs.1.90 crores (£1,425,000) in the fifth year. It is expected that by the fifth year the services will earn a profit of about 13 lakhs of rupees (approximately, £100,000).

The report of the Posts and Air Department leaves open the vexed question of State operation by a single "chosen instrument," or dependence on private enterprise. It simply suggests that the services may be established and operated either by the State, a statutory corporation, a single monopoly company or a limited number of companies. The Government of India must decide.

Precise details of the network under consideration in the "five-year plan" may not be disclosed. It may be said, however, that it covers the main centres of population in every part of the country, provides adequate connections with the trans-continental and world air routes which touch India, and is associated with a skeleton system of feeder services which is well apportioned to likely needs in the first few years after the war. Finally, the plan is sufficiently flexible—and the ground organisation available sufficiently elaborate and well-manned—for great extension and augmentation of the services contemplated, immediately the need shall arise. India will well repay the attention of the aircraft constructor who is prepared to cope with the peculiar needs which India shares with other tropical and climatically difficult regions.

Egypt and the Middle East

Cairo is already one of the chief junctions and regional headquarters along British Overseas Airways and Transport Command routes. It will soon be the base of as many B.O.A.C. aircraft as comprised the whole of the Corporation's fleet before the war. Cairo is, indeed, a natural Charing Cross of airway operation, and is as plainly destined for large expansion as a traffic centre.

As in India, the needs of war have greatly augmented the ground facilities available in Egypt and the nearby countries for airline operation. Large and well-equipped airfields have been laid down, enabling the biggest present-day transport aircraft to land and take off in safety and with expedition. Existing airfields, such as Almaza (Cairo), have been enlarged and their control, radio, weather and navigational equipment multiplied.

Again as in India, the Egyptian business community is deeply concerned that the advantages of air transportation shall be fully secured by a bold and imaginative government policy of expansion and the encouragement of free enterprise. The chief Egyptian air line company, Misr Airlines, has a good record of safe and regular operation, using in the main British aircraft. Egyptian mechanics and flying personnel have done well, and they will doubtless learn to cope with the more modern and more elaborate aircraft which will go into service in the near future.

No one in touch with Egyptian national aspirations will be surprised if the Government's plans for post-war airline expansion include a "prestige" service operated by an Egyptian company all of the way from Cairo to London, as well as greatly extended services across the Mediterranean to Greece, Italy, Turkey, and to Iraq, Persia, the Sudan, East Africa and Rhodesia. Services along the North African coast are also contemplated.

Price Considerations

Egypt, therefore, will need a limited number of main-line, ultra-modern aircraft. My guess is that the preference will be shown for twin-engined "improved DC-3" aircraft, rather than for the larger four-engined types. It must be remembered that companies such as Misr Airlines have been able to buy efficient twin-engined biplane transports at prices in the neighbourhood of £5,000. From £5,000 to £20,000—a reasonable price for a completely equipped twin-engined "mainliner"—is a large jump: to the first cost of four-engined aircraft of some 60,000 lb. all-up weight a much larger jump still. The greater complexity of the larger aircraft will also mitigate, in my view, against their adoption where it is desired, for nationalist as well as economic reasons, to employ the maximum of native labour on operation and maintenance. I have the impression that the Egyptians see their way clear to operation of the twin-engined types; in general, they do not, as yet, look so far ahead as the larger types. Nevertheless, politics and prestige might support more ambitious purchases; much would then depend on the scale of technical and engineering help which the aircraft manufacturer could make available, and on the availability of competent air crews.

So much for the main, extra-regional connections. There is also great scope in the region, which may be considered for the purpose of this survey to extend as far south as East Africa and even Rhodesia, for "bread and butter" or "bush" services. Before the war, many small companies had been launched, which depended for their existence on extremely low costs of operation, marked simplicity of upkeep, utter reliability, and adaptability of their aircraft to all kinds of difficult and roughly prepared flying fields.

Experts with whom I discussed this field agreed that there would be a considerable market for "utilitarian" aircraft, suitable for operation by modestly financed and thinly staffed companies. It was suggested to me that the companies already in the field—and others who might enter it—would favour operation, as at present, with a one-man crew and radio telephony. Slow landing speed was essential. Tyre pressure must be light. Fixed wheels were preferable, and should not be fitted with spats, which tend to gum up with mud in the rainy seasons. High-wing construction was thought to be most important, because—as in larger types—it provides a measure of shade for passengers and for loading operations, as well as a better view downwards.

There is no need, for these "bush flying" services, to provide the pilot-crew with a separate compartment. Experts with considerable first-hand experience in East Africa and elsewhere assured me that passengers like to be on friendly terms with the pilot and to watch him while he drives the machine and talks on the radio.

In general, metal aircraft were considered more serviceable, but it should be remembered that it is much easier "out back" to find a carpenter who can undertake makeshift repairs than it is to find a metal worker. Probably, as was suggested to me both in Egypt and West Africa, aircraft built of the modern improved and impregnated woods and plastic bonding materials will prove much more resistant to extremes of heat and humidity than the ordinary wooden aircraft, and much of the objection to the use of wood in the tropics may disappear.

One broad lesson may be derived from my talks in the Middle East. Undoubtedly the grand trunk routes of the world will demand the most extreme elaboration in equip-

BRITAIN'S OVERSEAS AIR SERVICES

ment, the highest feasible wing-loadings and the highest possible speeds. At the same time, there is an immense field of useful service for aircraft of relatively light wing loading, low landing speed and short take-off runs. Even speed is not always important. On many of the "utilitarian" routes, cruising at more than 150 m.p.h. is not worth the extra cost involved.

Canada

The cross-heading is too ambitious. My journey did not fit me to speak with authority on the Dominion's vast plans for post-war air expansion. Except that I am convinced that they are imagined on bold and far-reaching lines. The exceptionally favourable position of Canada on global air routes, the particular aptitude of Canadians in the operation and engineering control of aircraft, the obvious air-mindedness of the greater part of the population—all these assure a tremendous effort in air transportation immediately the power and skill now tied up in the air war become available for peaceful endeavour.

It would be equally presumptuous for me to estimate the precise strength of the forces which are driving the Canadian Government in the direction of monopoly control of all transcontinental and external services by a single "chosen instrument"—much though a representative of the British aircraft industry may distrust a policy which has been of singularly little worth to the British aircraft constructor. Nor is it my place to adjudge the mixture of politico-industrial reasons which lie back of the recent declaration that Canadian railways must divest themselves within one year of any share in the control of air transport systems.

My concern, in the short time at my disposal, was rather to discuss likely developments in the internal services which have already done so much to open up large regions in the Canadian north to mining and hunting enterprise, and have so greatly ameliorated the living conditions of settlers hundreds of miles inside the Arctic circle.

Canadian Conditions

Aircraft intended for such services must be designed for quick and rapid fitment with either floats or skis. Most of the flying done in large parts of the Dominion must be conducted from lakes and rivers, of which there is abundance. Landplanes simply cannot operate. Sturdiness, plenty of room in the fuselage, trouble-free running, provision for easy starting and operation in temperatures far below freezing point—these are essential. Ultra-high speed and frills are not necessary, nor desired.

Canada is the land of the Noorduyn Norseman, and the constructor who plans to attack the Canadian market—either as a home manufacturer from within or as a foreign (British or American) from without—should think along the lines indicated by that highly successful design. It is a "work-horse" of excellent achievement, and appears able to meet any demands. Indeed, too much is frequently asked of it. I heard, for example, of Norseman aircraft being loaded up to no less than 9,000 lb., which is a big load on 600 h.p., and not to be recommended.

A doubled-up Norseman, with two engines, would meet many Canadian needs. Operators are already thinking of such an aircraft, to be of general utility, suitable for the carriage of either passengers or freight, or a mixture of both. Wheels, floats and skis must be provided and readily interchangeable on the fixed undercarriage. Maximum speeds envisaged are not excessive. With floats, a cruising speed of 140 m.p.h. will meet requirements. Payload for an absolute still-air range of nearly 2,000 miles would be around 1,000 lb., and still-air take-off and landing should not occupy more than 800 yards.

Importance is attached to quick and easy loading of freight. Cargo doors must be high and wide and the floor structure capable of withstanding concentrated loads at any point. There must be no excrescences or internal strutting to break the cabin space and to interfere with handling of cargo. De-icing needs would probably be severe—installation of wing de-icing and full provision for carburettor and windshield de-icing.

That is the kind of aircraft which Canadian "bush" flying will probably use within the next few years. Experience of Canadian winter conditions, and a readiness to accept the advice of Canadian operators and engineers, are vital to success in satisfying a worthwhile market.

Light Aircraft

Present insistence on post-war airline operations tends to cast into the shade one aspect of future development in which I found interest everywhere. Light aircraft of the "owner-driver" type, for use by private flyers as well as by charter and feeder service operators, will undoubtedly command a large market—if their production and sale are backed by adequate supply of spares and full facilities for servicing overseas.

In every region which I visited the British manufacturer is likely to meet severe competition from the American aircraft industry, which—as in the automobile field—will be backed by a big home market in the United States. American Government spokesmen have forecast that no fewer than half a million private aircraft will be operating in the States within ten years from now. With such a background, costs of exported light aircraft are bound to be low.

Nevertheless, the precise effects of lower British labour costs and the possible influence of cheaper production methods—for example, the simplification of methods of "cooking" plastic fuselages and other main components—might prove important, and pessimism is not justified.

Figures obtained in so highly industrialised and so large a homogeneous area as the United States are difficult of transference to less-favoured regions, but the British Empire offers possible outlets for light aircraft which one day may rank with even the American flood. Countries like India have many wealthy young men who will wish to fly their own aircraft. Canada, Australia, South Africa and New Zealand will see the return of many thousands of men from the Forces who have flying in their blood and who will wish to become aircraft owners. Flying clubs may be expected to flourish. Countries like Egypt have a large number of rich families, able to provide many owner-drivers as well as lavish users of small special charter aircraft.

My chief impression, as a representative of the aircraft industry, from my all too brief study of post-war potentialities, is the general insistence on the need for practical, workaday aircraft. Almost equally clear was the need for early development of suitable medium and small transport aircraft in Great Britain. Time now lost will be difficult to regain. The inertia which acts against change will be a powerful factor in favour of the industry which gets in first. Once mechanics have learned a foreign technique, storekeepers have grasped foreign terms and methods, and the necessarily close and elaborate liaison with foreign manufacturers has been established, the inculcation of fresh lessons will be difficult and the introduction of British types all the harder.

No one in the British aircraft industry expects the British Government to countenance any work which would adversely affect the war effort. Nevertheless, a greater measure of encouragement should not be impossible of arrangement. A little work now will be worth a great deal later on, when our competitors may have secured much more than a head start.

Mr. E. C. Bowyer, who is chief of the information department of the Society of British Aircraft Constructors, wishes us to make it clear that the views which he expresses are entirely his own and are not to be taken as necessarily representing those of the S.B.A.C., on whose behalf he made the journey of 25,600 miles by air. There will be another article from him next week.

CORRESPONDENCE

The Editor does not hold himself responsible for the views expressed by correspondents. The names and addresses of the writers, not necessarily for publication, must in all cases accompany letters.

INFORMATION LEAKAGE

N.A.S.C. Not Guilty

I HAD no wish to join in the "mud-slinging contest" which has appeared in your journal recently under the heading of "Information Leakage," but I have been compelled by Cadet E. G. Farman in the May 18th issue to take up arms for the N.A.S.C.

It is an utter impossibility for an N.A.S.C. member to divulge secret information concerning our later types of aircraft, for the very simple reason that they do not receive it. The terms of priority which is allowed to us (and then only to bona fide raid-spotting members, and not to any of our other sections) are that the aircraft must have "flown in the face of the enemy." This is the last and least grade, and by the time the Air Ministry is sure that the enemy has had a good look at the aircraft and the release has passed through the various official channels, even the schoolboys know it by sight and name!

The A.T.C., I believe, are granted information when the aircraft goes into squadron service—which is one grade higher than us, but, again, not so very "secret."

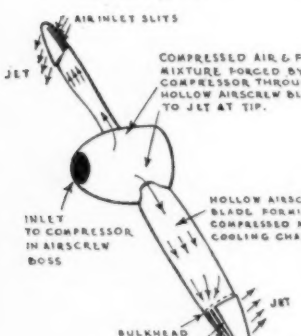
I have my own ideas where a lot of the leakage occurs, but will keep them to myself, for, as I said at the start, I do not want to suffer the indignity of participating in a slanging match.

G. F. L. COTGROVE.
(Publicity Officer, N.A.S.C.)

JET PROPULSION OF AIRCRAFT

Application to Airscrew Rotation

COULD one of your readers give me an opinion as to the possibility of applying jet reaction to rotate airscrews, as I am under the impression that a combination of small jet units


AIR INLET SLITS
JET
COMPRESSED AIR & FUEL MIXTURE FORCED BY COMPRESSOR THROUGH HOLLOW AIRSCREW BLADE TO JET AT TIP.
INLET TO COMPRESSOR IN AIRSCREW BOSS
HOLLOW AIRSCREW BLADE FORMING COMPRESSED MIXTURE COOLING CHAMBER
JET
BULKHEAD
AIR INLET SLITS

located at the tip of each airscrew blade, providing indirect jet propulsion via the usual airscrew combination, would be more efficient, at normal flying speeds, than a proportionally larger jet unit applied in the conventional manner, providing direct jet propulsion.

The late Señor de la Cierva's suggestion of the possibility of applying jet reaction to rotate rotors of rotating-wing aircraft, as mentioned in previous issues of *Flight*, is, to my knowledge, the only instance of anyone considering this particular application of jet reaction.

Surely there are others who have considered the application of jet reaction to the airscrew in the manner suggested and as shown in the enclosed sketch. If not, why not?

ROBERT SHORTER.

FUTURE OF CIVIL AVIATION

Freight Pays Better Than People

SIR ROY FEDDEN'S lecture on the future of civil aviation, from a technical point of view, is most interesting and instructive, with the exception that he almost entirely neglects the freight-carrying machine of large capacity and moderate speed, which is a machine, in my opinion, that has not yet been properly developed.

The correct design for this type of machine is the "Tandem" system given such prominence in *Flight* of late, and I have designed machines of this type ranging from 100 tons to 300 tons, which are 25 per cent. more efficient than the orthodox type of machine. These are, of course, flying boats, as 100 tons and 300 tons cannot be landed on an undercarriage.

Having had a considerable amount of experience in railway operation both in England and in South America, I am shocked at the very scant knowledge shown in aviation circles of the carrier business, for the simple reason that they put passenger-carrying first and foremost in their airline companies, and, in fact, do not consider freight at all. Railway and shipping companies, on the other hand, think little or nothing of passenger traffic, as it is not considered a paying proposition. They carry passengers purely as an advertisement, and more or less as an obligation to the public, but I can assure you they do not pay.

Now here we have the reason for the airline companies' lack of profit, which is simply due to their lack of experience in the carrier business.

I am quite convinced that the airline would show a good profit if it were to adopt the policy of carrying freight as the basis of its business and treat passenger carrying as a secondary consideration. There is plenty of freight of all descriptions that wants carrying at high speed over long distances. The future of civil aviation, therefore, is dependent, not on the passenger-carrying machine, but on the freight-carrying machine of the tandem type, with a pay load of 100 tons.

J. R. GOULD.
(Major, late R.A.F.)

STATUS OF DRAUGHTSMEN

Objects of the A.E.S.D.

THE letter from Mr. A. R. Short which appeared in your issue of May 11th calls for comment on behalf of the 40,000 members of the Association of Engineering and Shipbuilding Draughtsmen, if only to provide some information which appears to be lacking.

Mr. Short mentions three items in the aim of an institution such as he contemplates: (1) To raise the status of draughtsmen; (2) to bring draughtsmen together in the manner of the professional engineering bodies by means of debates, lectures and industrial visits; and (3) to encourage young draughtsmen by practical recognition of their technical successes at an earlier date than would be the case with the professional bodies.

The purpose of this letter is to point out that all three of these are prominent in the objects of the Association. In regard to the first, the view has consistently been held throughout the existence of the Association that the status of draughtsmen and their colleagues (designers, calculators, engineering estimators and planners) is largely covered in the practical recognition of their services to the industry by adequate remuneration and satisfactory working conditions, which when achieved will bring with them the true "status" required. And, as for the second, the Association has had for many years a policy of publication of technical pamphlets and text-books, lectures and works visits, which is also directed to the elevation of status of its members by the improvement of their technical qualifications. The publications, which sell in thousands, deal with all branches of engineering and shipbuilding, and are highly thought of by employers and staffs alike.

As regards the third point, the younger members are actively encouraged by the Association's technical work in which they participate; and it is not clear how ability to call themselves junior associates, etc., of an Institution, which is avowedly to be of a lower standard than those already in existence, will provide any additional and lasting encouragement.

It was recently suggested in a reply to Mr. Short by the Editor of another well-known technical journal that "it is a little difficult to see how a new institution formed specifically for draughtsmen could offer better advantages or, indeed, any that are as good" as those provided by the existing bodies. I would venture to state that the Association of Engineering and Shipbuilding Draughtsmen can, as regards its technical work, be claimed to be a body which has existed for some considerable time and which has fulfilled the purposes proposed by the writer of the letter which appeared in your columns.

PETER DOIG.
(General Secretary, Association of Engineering and Shipbuilding Draughtsmen.)

SERVICE AVIATION

Royal Air Force and Fleet Air Arm News and Announcements

FLAP ON : A Corsair takes off during the recent operations against a German convoy off Bodo in Northern Norway.

Retirement

TECHNICAL BRANCH.

GROUP CAPT. (temp. Air Comdre.) C. TURNER, A.F.C., is placed on the retired list and retains the rank of Air Comdre. May 21st, 1944.

MEDICAL BRANCH.

Group Capt. (temp. Air Comdre.) R. H. KNOWLES, M.D., M.B., B.Ch., is placed on the retired list and is re-employed. August 2nd, 1943.

Awards

Fleet Air Arm

THE KING has been graciously pleased to approve the following awards for outstanding courage, resolution, leadership, skill or devotion to duty in H.M. ships in operations which led to successful landings on the Italian mainland and at Salerno :—

Distinguished Service Cross

Act. Temp. Lt. Cdr. (A) W. C. SIMPSON, R.N.V.R.
Act. Temp. Lt. Cdr. (A) G. A. WOOD, R.N.V.R.

Royal Air Force

THE KING has been graciously pleased to approve the following awards in recognition of gallantry displayed in flying operations against the enemy :—

Distinguished Service Order

Flt. Lt. J. SINGLETON, D.F.C., R.A.F.V.R., No. 25 Sqn.—Since being awarded the D.F.C. this officer has completed very many sorties. Within a short period he has destroyed five enemy aircraft at night, three of which he shot down in one sortie. On this occasion his aircraft was damaged but he flew it to this country. When nearing an airfield both engines failed and caught fire. Nevertheless, Flt. Lt. Singleton effected a successful crash-landing. After getting clear he returned to the burning aircraft and switched off all the electrical circuits. Afterwards, unaided, he succeeded in extinguishing the flames by smothering them with earth. This officer, who displayed a high degree of courage, coolness and devotion to duty, undoubtedly saved his aircraft from becoming a total loss.

F/O. H. H. FARMILOE, R.A.F.V.R., No. 61 Sqn.—One night in March, 1944, this officer piloted an aircraft detailed to attack Berlin. When nearing the target the port inner engine caught fire. Two minutes later the port outer engine became defective and had to be feathered. In spite of this, F/O. Farmiloe continued to the target. Much height and air speed were lost, whilst with its full bomb load the aircraft was difficult to control. Nevertheless, F/O. Farmiloe maintained a steady course and finally released his bombs over the target. The aircraft was still losing height as course was set for home. Some time later all movable equipment, including guns and ammunition, were jettisoned and the enemy coast was crossed at a height of 6,000 feet. The situation was extremely serious, but F/O. Farmiloe resolutely held to his course and the North Sea was safely crossed and an airfield was reached. This gallant pilot displayed outstanding determination in pressing home his attack with one engine on fire, and his great skill and coolness in the face of increasing difficulties on the homeward flight set an example of the highest order.

Bar to Distinguished Flying Cross

Flt. Lt. A. D. WAGNER, D.F.C., R.A.F.V.R., No. 605 Sqn.—Since being awarded the D.F.C. this officer has completed very many sorties at night and has displayed skill, gallantry and devotion to duty of a high order. One night in March, 1944, whilst over enemy territory, Flt. Lt. Wagner engaged first a Fw 190 and then two Me 410s, all of which he shot down. In the last of these fights, Flt. Lt. Wagner pressed home his attack at such close range that his aircraft was enveloped in burning petrol and oil which obscured the windscreen and burned the outer covering of the fuselage and the tail unit. Despite this, Flt. Lt. Wagner intercepted another enemy aircraft which he attacked with damaging effect. He has now destroyed a further four enemy aircraft, all of them at night.

Distinguished Flying Cross

Sqn. Ldr. C. W. McN. NEWMAN, R.A.F., No. 613 Sqn.
Act. Sqn. Ldr. H. S. LISSON, R.C.A.F., No. 418 (R.C.A.F.) Sqn.
Act. Sqn. Ldr. M. NEGUS, R.A.F., No. 605 Sqn.
Act. Flt. Lt. F. TAYLOR, D.F.M., R.A.F.V.R., No. 78 Sqn.
F/O. J. BRADBURN, R.A.F.V.R., No. 44 Sqn.
F/O. C. G. FINLAYSON, R.C.A.F., No. 418 (R.C.A.F.) Sqn.
F/O. A. E. FRANKLIN, R.C.A.F., No. 418 (R.C.A.F.) Sqn.
F/O. E. R. HEDGECOE, R.A.F.V.R., No. 85 Sqn.
F/O. R. C. MUIR, R.A.F.V.R., No. 605 Sqn.
F/O. E. T. ORRINGE, R.A.F.V.R., No. 605 Sqn.
F/O. B. J. STANDISH, R.A.F.V.R., No. 613 Sqn.
F/O. A. J. WALKER, R.A.F.V.R., No. 75 Sqn.
F/O. J. A. BATE, R.A.F.V.R., No. 76 Sqn.
Wing Cdr. S. D. TURNER, R.C.A.F.
Sqn. Ldr. D. G. KNOX, R.C.A.F., No. 117 (R.C.A.F.) Sqn.
Sqn. Ldr. R. F. MILNE, R.C.A.F., No. 10 (R.C.A.F.) Sqn.
Flt. Lt. G. R. HARLAND, R.C.A.F., No. 10 (R.C.A.F.) Sqn.
Flt. Lt. J. H. SANDERSON, R.C.A.F., No. 10 (R.C.A.F.) Sqn.
F/O. P. C. E. LAFOND, R.C.A.F., No. 10 (R.C.A.F.) Sqn.
W/O. 2nd Cl. D. G. BUSH, R.C.A.F., No. 11 (R.C.A.F.) Sqn.

Distinguished Flying Medal

Sgt. T. E. CAMPBELL, R.C.A.F., No. 117 (R.C.A.F.) Sqn.
Sgt. H. VAN DEN BOS, R.A.F.V.R., No. 75 Sqn.
Sgt. L. P. L. MARVIN, R.A.F.V.R., No. 76 Sqn.

THE KING has been graciously pleased to approve the following awards :—

O.B.E. (Mil.)

Act. Sqn. Ldr. R. C. SCOTT, R.C.A.F.—One night in December, 1943, a Halifax aircraft crashed in the vicinity of an airfield and burst into flames. Sqn. Ldr. Scott, the station engineer officer, was one of the first to arrive at the scene of the accident and immediately took charge of the rescue party in a cool and efficient manner. Seeing one

Flt. Lt. R. E. Holgate showing his sister the D.F.C. which he had just received at an investiture.

member of the crew trapped inside the rear turret, he entered the blazing fuselage from the front and walked towards the rear in an endeavour to rescue the airman. Sqn. Ldr. Scott was at first driven back by the heat and smoke, but, displaying great determination, he repeated his effort and succeeded in reaching the turret and in passing the injured airman to safety through a hole in the rear. He then ensured that there were no further members of the crew left before he made his way out. Sqn. Ldr. Scott displayed courage and devotion to duty in the face of fire, and of the further danger that the petrol tanks might have exploded whilst he was engaged in the rescue. He was undoubtedly responsible for saving the airman's life.

M.B.E. (Mil.)

F/O. R. M. MACKENZIE, R.A.A.F., No. 168 Sqn.—In very harassing circumstances F/O. Mackenzie displayed great determinatiaon, courage and devotion to duty.

George Medal

F/O. G. C. ABEL, R.C.A.F., No. 36 Sqn.—In November, 1943, F/O. Abel was a member of the crew of an aircraft detailed for an operational sortie. Shortly after taking off, the pilot was compelled to make an emergency landing, and, on touching the ground, the aircraft burst into flames. The crew, who had taken crash positions, proceeded to leave the aircraft through the emergency exits. F/O. Abel, with his companions, had travelled a distance of approximately 60 yards before he realised that one member of the crew, the rear gunner, was missing. The aircraft was blazing furiously and ammunition was exploding; there was also the grave risk of the petrol tanks and the bombs exploding. F/O. Abel, ignoring the imminent danger, returned to the aircraft, calling on the other members of the crew to follow him. The rear gunner was discovered trapped in his turret which, together with the exits, had become jammed. Efforts were made to turn the turret, but this the rescuers found to be impossible. F/O. Abel then smashed the Perspex with his bare hands, and succeeded in dragging the rear gunner clear of the wreckage. When all were about 20 yards from the aircraft the first bomb exploded, and the aircraft was soon completely destroyed. By his courage and leadership F/O. Abel undoubtedly saved his comrade's life at the risk of his own.

Flt. Sgt. B. MCDONAGH, R.A.F.V.R.—In January, 1944, a Wellington aircraft caught fire in the air. Flt. Sgt. McDonagh, an air gunner under training, was instructed by the captain to come forward from the rear gun position, but, whilst so doing, the aircraft crashed; he was rendered unconscious and thrown up into the fuselage. The aircraft was blazing furiously. Flt. Sgt. McDonagh regained consciousness and was able to extricate himself from the blazing wreckage. Although badly dazed and suffering from abrasions to his legs and body, he immediately went to the front of the bomber, where he found the pilot, who was unconscious in the flames and still strapped in his seat. Flt. Sgt. McDonagh succeeded in releasing the pilot and in dragging him to safety. He then returned to the aircraft on two more occasions, and rescued the navigator and the air bomber. The latter was, unfortunately, dead. Flt. Sgt. McDonagh's outstanding courage and complete disregard for danger undoubtedly saved two lives.

Sgt. L. W. PRESTON, R.A.F.V.R., No. 140 Sqn.—One morning in January, 1944, Sgt. Preston was the navigator of an aircraft which crashed into an electrical transformer and burst into flames. Sgt. Preston sustained facial burns, but was thrown clear of the aircraft. The pilot, who was left in the cockpit, sustained a broken leg, and, although he had released his straps, he was unable to get out unaided. His cockpit was soon enveloped by the flames. Displaying complete disregard for his own safety, Sgt. Preston returned to the blazing aircraft and, working in the flames, succeeded in dragging the pilot to safety. In so doing Sgt. Preston sustained second degree burns. His gallant and prompt action saved the pilot's life. Sgt. Preston was also involved in a similar accident in November, 1943, when he succeeded in dragging the pilot clear. On this occasion the aircraft did not catch fire, but there was a constant possibility of its doing so.

Sgt. C. G. KENT, R.N.Z.A.F.—When a flare accidentally became ignited among a stack of bombs and depth-charges, Sgt. Kent, well aware that a major explosion was likely, hurried to the spot and endeavoured to remove the flare. In his first attempt he had his left hand burned, but, regardless of his own safety, he persisted and removed the flare, still burning fiercely, to a place of safety. He suffered further severe burns before succeeding in an action which ensured the safety of other personnel, and saved a number of aircraft from almost certain destruction.

THE KING has been graciously pleased to approve the following awards:—

Air Force Cross

Wing Cdr. B. ANDREW, R.C.A.F.
Act. Wing Cdr. J. S. HAMILTON, R.A.F.V.R.
Sqn. Ldr. E. H. GALE, R.C.A.F.
Sqn. Ldr. J. S. HOWDEN, R.C.A.F.
Act. Sqn. Ldr. E. J. HAYES, R.A.F.
Flt. Lt. G. D. JEFFREY, R.C.A.F.
Flt. Lt. G. A. LEE, R.C.A.F.
F/O. B. ARMER, R.C.A.F.
F/O. C. A. DICKSON, R.C.A.F.
F/O. H. B. HILLCOAT, A.F.M., R.C.A.F.
F/O. F. B. LABRISH, R.C.A.F.
F/O. A. W. MOORE, R.C.A.F.
F/O. J. PATTON, R.C.A.F.
P/O. E. M. ROSENBAUM, R.C.A.F.
P/O. G. N. P. SEELER, R.C.A.F.
W/O. 1st Cl. W. J. DUNCAN, R.C.A.F.

Air Force Medal

Cpl. A. DE MARCO, R.C.A.F.

THE KING has been graciously pleased, on the advice of His Majesty's Canadian Ministers, to approve the following awards:—

B.E.M. (Mil.)

Sgt. R. R. BARKER, R.C.A.F.
Sgt. G. A. HARE, R.C.A.F.
Cpl. W. W. RIGLIN, R.C.A.F.

Foreign Decorations

THE KING has granted unrestricted permission for the wearing of the undermentioned decorations conferred upon the officers indicated in recognition of valuable services rendered in connection with the war:—

Conferred by Her Majesty the Queen of the Netherlands

Flight Cross

Act. Wing Cdr. R. N. BATESON, D.S.O., D.F.C., R.A.F.O.

Conferred by the President of the Republic of Poland

Virtuti Militari (5th Class)

Flt. Lt. E. J. HARROD, R.A.F.

Krzyz Walecznych (Cross of Valour)

P/O. J. A. WELLS, R.A.A.F.
P/O. N. WILCOCK, R.A.F.

Conferred by the President of the United States of America

Legion of Merit (Officer)

Sqn. Ldr. H. C. WALKER, A.F.C., R.N.Z.A.F.

Conferred by the President of the National Government of the Republic of China

Order of the Sacred Tripod (Paoting)

Group Capt. J. WARBURTON, R.A.F.

Roll of Honour

Casualty Communiqué No. 389.

THE Air Ministry regrets to announce the following casualties on various dates. The next of kin have been informed. Casualties "in action" are due to flying operations against the enemy; "on active service" includes ground casualties due to enemy action, non-operational flying casualties, fatal accidents and natural deaths.

Of the names in this list 105 are second entries giving later information of casualties published in earlier lists.

Royal Air Force

KILLED IN ACTION.—Sgt. A. G. Beeston; Flt. Lt. A. L. B. Bent; P/O. F. J. Cooke; P/O. G. L. Coster; L.A/C. E. Eliav; F/O. P. Harrison; Flt. Sgt. W. McL. Jack; Flt. Sgt. J. G. Jones; F/O. E. A. Knight; Sgt. J. J. Yeates.

PREVIOUSLY REPORTED MISSING, BELIEVED

SERVICE AVIATION

FLYING CLASSROOM: The D.H. Dominie, alias D.H. Rapide, alias D.H. 89, has flown thousands of hours in the service of wireless-operator training schools since the outbreak of war.

MORE HAVOC: The Douglas A 20 now has a power turret housing two 0·5in. machine guns. As a fighter-bomber it carries 2,000 lb of bombs and nine machine guns. The bomber version has five machine guns. Russia has had over 2,000 A 20s under lend/lease arrangements.

KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Flt. Sgt. B. E. Adams; Sgt. H. A. Gordon; Sgt. A. E. Gourd; Sgt. A. T. Milton; Flt. Sgt. A. I. Mitchell; Flt. Lt. K. S. Smith.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Flt. Lt. J. T. Anderton; Sgt. E. T. Barry; Sgt. G. H. Bennett; Sgt. A. T. Bishop; F/O. L. H. Burn; P/O. H. J. Burridge; Flt. Sgt. D. Campbell; F/O. R. Clarke; Flt. Sgt. E. Cogman; Flt. Sgt. F. G. Crocker; F/O. C. Daniel; Sgt. T. E. Dickins; F/O. I. D. C. Evans; P/O. A. W. Farquharson, D.F.M.; Sgt. A. W. G. Fox; Sgt. N. H. Frank; Sgt. J. P. McM. Garland; Sgt. H. C. Hambling; F/O. E. H. Hawkins; Sgt. T. A. Hicks; Sgt. L. Hocking; P/O. I. A. M. Holloway; Sgt. W. J. Hood; F/O. J. M. Lord; Sgt. W. W. McLellan; Flt. Sgt. J. A. Marsden; Sgt. J. Marsh; Flt. Sgt. G. Neil; Act. Flt. Lt. J. D. Nesbitt; Sgt. E. W. V. Pierce; Sgt. J. E. Potts; F/O. L. G. Rembridge; Flt. Sgt. W. A. Russell; Sgt. A. Slack; P/O. N. Smyth; F/O. A. D. S. Snell; Sgt. J. H. Sowerby; Flt. Sgt. K. C. Starmer; P/O. S. C. Sykes; Act. Wing Cdr. A. M. Taylor, D.F.C.; Sgt. J. Tindall; F/O. J. S. Treseder; F/O. J. M. Warren.

DIED OF WOUNDS OR INJURIES RECEIVED IN ACTION.—Act. Wing Cdr. J. K. Buchanan, D.S.O., D.F.C.

MISSING, BELIEVED KILLED IN ACTION.—F/O. D. Draper; Flt. Sgt. P. N. Woolley.

MISSING.—F/O. T. J. Adamson, D.F.M.; Sgt. E. J. Atkinson; Sgt. G. Bagnall; Sgt. C. H. Baker; Sgt. R. S. Barratt; Sgt. C. Beech; Flt. Sgt. G. F. Bishop; F/O. A. A. Boad; F/O. P. A. Bradley; Sgt. P. C. Brown; Sgt. J. W. S. Burden; Flt. Sgt. A. V. C. Campbell; Sgt. T. D. Cant; Sgt. N. J. Capstick; P/O. F. A. Carter; Sgt. L. J. A. Casey; Sgt. S. W. Chalcraft; F/O. M. F. Culling; Sgt. J. Davies; Sgt. N. J. Davis; F/O. C. J. Elmer; W/O. P. J. Fairclough; Sgt. R. Favager; F/O. E. W. W. Feldon; F/O. A. Ganderton; Flt. Sgt. C. O. Gibbons; Sgt. E. R. Groves; Flt. Sgt. J. Harris; Sgt. J. Hesketh; F/O. J. H. Hood; Flt. Sgt. A. Jory; F/O. G. A. King; W/O. J. W. F. King; Sgt. A. J. Little; Flt. Sgt. J. D. Lomas; Sgt. H. R. Lowman; Flt. Lt. W. J. A. Mackay; Sgt. H. L. Madden; Sgt. F. W. Marchant; Sgt. J. S. Martin; Act. Flt. Lt. J. G. Moore, D.F.M.; P/O. E. H. Moulden; Sgt. N. C. New; Act. Sqn. Ldr. D. G. H. Pike; Flt. Sgt. J. H. Pownall; Sgt. R. B. Priestley; Sgt. A. McL. Reid; P/O. J. M. Rodger; Sgt. F. C. Ryall; Sgt. A. Shaw; Sgt. A. R. Skelton; Flt. Lt. E. J. D. Stanley; F/O. W. N. Taylor; Sgt. W. Thompson; Sgt. A. H. Weller; Flt. Sgt. R. A. Werrett; W/O. J. Westermark; P/O. R. A. Wheeler; Flt. Sgt. R. M. Woods.

MISSING, BELIEVED KILLED ON ACTIVE SERVICE.—Sgt. C. S. McG. Averill; P/O. F. S. Knighton; Sgt. E. K. J. Potter.

KILLED ON ACTIVE SERVICE.—Flt. Sgt. J. V. Avery; F/O. J. D. M. Baillie; Sgt. H. D. Barlow; Act. Wing Cdr. D. S. Bateman; Sgt. A. F. Bogan; Sgt. N. P. Bond; Flt. Sgt. W. R. Goodwin; Sgt. J. R. Graham; Flt. Sgt. G. Hudson; P/O. A. J. Inns; Sgt. R. R. Kemp; Flt. Sgt. E. L. Maybee; L.A/C. R. C. Miller; Flt. Lt. R. M. Napier; Flt. Sgt. J. R. Newman; Sgt. B. H. Norman; Sgt. B. H. Pattenden; Sgt. L. F. Pepper; Sgt. S. A. Philpot; Sgt. H. G. Reason; L.A/C. R. J. Strawbridge; Flt. Sgt. B. H. Symes; F/O. R. Taylor; Sqn. Ldr. G. E. Thompson; F/O. W. M. A. Van Leemputten; Sgt. N. White.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED ON ACTIVE SERVICE, NOW PRESUMED KILLED ON ACTIVE SERVICE.—P/O. A. Agar.

WOUNDED OR INJURED ON ACTIVE SERVICE.—Sgt. D. J. Champion; Sgt. G. D. Pearson; Flt. Sgt. C. W. Powell; Flt. Sgt. E. Walker.

DIED OF WOUNDS OR INJURIES RECEIVED ON ACTIVE SERVICE.—A/C.2 J. R. M. Critchley.

DIED ON ACTIVE SERVICE.—Act. W/O. A. E. Alberry; A/C.1 H. Asken; L.A/C. T. Banks; L.A/C. F. R. H. Beard; L.A/C. L. G. Brown; Cpl. M. T. Gornall; A/C.2 A. McD. Gow; Cpl. T. A. Haycraft; Cpl. A. Holmes; L.A/C. V. S. Howarth; L.A/C. M. McKenzie; L.A/C. G. P. Marshall; A/C.2 M. Nagle; A/C.2 D. J. Nelson; Cpl. C. C. J. Newman; L.A/C. F. L. Passey; Cpl. J. T. Payne; L.A/C. A. F. Roberts; L.A/C. J. F. Sefton; Sgt. F. W. Simmons; L.A/C. H. Sugden; L.A/C. A. J. Tailby; L.A/C. A. R. Talbot; A/C.1 L. C. G. Wadlow; A/C.2 A. G. Ward; Sgt. J. Warren; Cpl. J. S. Young.

PREVIOUSLY REPORTED MISSING, NOW REPORTED PRISONER OF WAR.—Cpl. E. C. Hodgson; Sgt. R. McDonald; A/C.2 B. P. Maller.

Women's Auxiliary Air Force

DIED ON ACTIVE SERVICE.—A/CW.1 L. M. Ward.

Royal Australian Air Force

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Flt. Sgt. W. Brown.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—F/O. G. Silva, D.F.C.

MISSING.—Flt. Sgt. F. J. Brown; F/O. K. Fuller; Flt. Sgt. A. W. J. Kempnich; Flt. Sgt. N. A. McAllister; P/O. D. J. Munro; F/O. T. J. O'Donoghue, D.F.M.; F/O. A. L. Pearsall; F/O. A. H. Ringland; W/O. J. D. Seymour; W/O. J. E. Stapleton; F/O. F. M. Wilson; F/O. J. S. Wright.

KILLED ON ACTIVE SERVICE.—F/O. J. H. S. Lyon, D.F.C.; Flt. Sgt. D. W. Pettitt.

PREVIOUSLY REPORTED MISSING, NOW REPORTED PRISONER OF WAR.—Flt. Sgt. G. T. Agg; F/O. D. V. Paul.

Royal Canadian Air Force

KILLED IN ACTION.—F/O. H. Cox.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—F/O. R. C. Baillie; P/O. J. O. R. Bonefant; W/O. G. C. Bradley; F/O. D. E. Bruce; Sgt. L. E. Corley; P/O. R. Cossette; Sgt. C. W. Ellard; F/O. R. O. E. Goodwin; F/O. W. A. Grant; P/O. F. P. Harrison; Flt. Sgt. W. M. T. Hetherington; Sgt. G. A. P. Johannesson; Flt. Sgt. J. F. R. Laurence; Flt. Sgt. K. W. Lawson; Flt. Sgt. D. G. McKay; Sgt. M. R. E. Metcalfe; F/O. A. A. Shepherd; F/O. C. Shnier; F/O. J. A. Smith; F/O. A. O. Smuck; F/O. L. W. Somers; P/O. M. C. Staples; Flt. Sgt. L. G. Stewart; Sgt. D. A. Turner; Flt. Sgt. A. L. Wood; Flt. Sgt. G. H. Woodcock.

MISSING, BELIEVED KILLED IN ACTION.—F/O. J. H. Ballantyne, D.F.M.; W/O. F. N. Depew.

MISSING.—F/O. K. G. Chandler; W/O. R. C. Gaudet; P/O. C. Grant; P/O. P. McD. MacIntyre; W/O. O. C. Markle; F/O. E. M. O'Donnell; F/O. T. W. Pearson; Sgt. G. E. R. Robineau; W/O. I. E. Smithson; F/O. H. C. Sorley; W/O. F. L. Travers.

MISSING, BELIEVED KILLED ON ACTIVE SERVICE

PACKERS TO THE ARMY; Special mobile units of the R.A.F. have the responsible job of packing, drying and generally maintaining the parachutes used by airborne troops.

SERVICE AVIATION

—W/O. N. D Campbell; W/O. G. A. A. A. Caron.

KILLED ON ACTIVE SERVICE.—Sgt. J. J. Bailie; F/O. R. W. Warden.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED ON ACTIVE SERVICE.—F/O. C. R. Thomas.

WOUNDED OR INJURED ON ACTIVE SERVICE.—Flt. Sgt. R. T. Sinclair.

DIED ON ACTIVE SERVICE.—L.A/C. A. S. Blanchard; F/O. W. D. Gilbert.

PREVIOUSLY REPORTED MISSING, NOW REPORTED PRISONER OF WAR.—Flt. Sgt. R. H. Masters; F/O. W. C. Poole.

Royal New Zealand Air Force

KILLED IN ACTION.—Act. Wing Cdr. R. J. C. Grant, D.F.C., D.F.M.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—P/O. W. D. Caldwell.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Flt. Sgt. R. C. Armstrong; Flt. Sgt. E. H. Capewell; Flt. Sgt. T. L. Cowin; F/O. B. V. Crawford; Flt. Sgt. G. P. McBain; Flt. Sgt. R. G. J. McKenzie; Sgt. D. G. McNab; Flt. Sgt. R. G. Miles; W/O. K. McF. Moon; Flt. Sgt. A. B. Parton; F/O. R. J. Peattie; F/O. W. R. Perrott; Flt. Sgt. J. L. Richards; Flt. Lt. M. J. Rowland; Flt. Sgt. E. W. Saywell; Flt. Sgt. R. Thomas; Flt. Sgt. E. J. Twigg; Flt. Sgt. C. J. Whitelaw.

MISSING.—F/O. A. Crozier; F/O. H. W. Henderson; P/O. A. S. Jones; Flt. Sgt. R. J. I. Melville; Act. Sqn. Ldr. R. J. Watson, D.F.C.

KILLED ON ACTIVE SERVICE.—Flt. Sgt. D. V. R. Francis; F/O. G. H. Gilbert; Flt. Sgt. A. F. Goold.

South African Air Force

KILLED IN ACTION.—Lt. J. C. Aronson.

MISSING.—Act. Flt. Sgt. A. B. Aeken; 2/Lt. A. M. Bain; Lt. G. A. Bowles; Lt. C. T. M. Cockburn; Flt. Sgt. D. H. Collins; Flt. Sgt. G. A. Dingle; Lt. G. M. H. Duplessibe; Air Sgt. J. F. Fourie; Capt. G. Frolich; Capt. J. H. Gaynor, D.F.C.; Flt. Sgt. K. R. Healy; Flt. Sgt. Johnson; W/O. D. R. McCrindle; Lt. F. W. Phillips; Flt. Sgt. P. J. Pretrius; Lt. V. C. Richards; Lt. G. P. Rowe; 2/Lt. Rutkin; Flt. Sgt. Smith; Lt. J. P. Van Epen.

DIED ON ACTIVE SERVICE.—I. A. Paice.

Casualty Communique No. 390.

Of the names in this list 96 are second entries giving later information of casualties published in earlier lists.

Royal Air Force

KILLED IN ACTION.—Flt. Sgt. W. A. Ballard; Act. Flt. Lt. J. H. Botham; Act. Flt. Lt. G. W. Carter; Flt. Sgt. W. Gittins; Flt. Sgt. H. W. Hill; Flt. Sgt. C. R. C. Hoddinott; Flt. Sgt. J. P. Hutcheson; F/O. H. G. Lancaster; Flt. Sgt. J. M. Lawrie; Sqn. Ldr. D. D. McPetrie; Flt. Sgt. B. J. C. Martin; Sgt. J. B. Morton; Sgt. T. J. Robinson; Flt. Sgt. C. E. Sayer; Flt. Sgt. H. S. Taylor.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Sgt. R. E. Archer; F/O. C. H. Ashworth; Sgt. E. S. Barber; Sgt. G. Beans; Sgt. S. Bonner; Sgt. A. G. Broadmore; Sgt. A. Clark; F/O. J. Clark, D.F.M.; Sgt. W. H. R. Clark; Flt. Sgt. F. R. Duxbury; Sgt. J. Ferguson; Sgt. G. M. Hacker; Sgt. D. Hamilton; Sgt. J. W. Heald; Flt. Lt. G. Hood; Sgt. G. C. Hutton; W/O. W. A. McCroddan; Wing Cdr. P. R. May, D.F.C.; Flt. Sgt. J. Parker; Flt. Sgt. E. P. H. Peek; F/O. F. Perkins; Sgt. W. A. Poulton; Sgt. N. W. Procter; Flt. Sgt. W. F. Pyle; Sgt. B. Spencer; Sgt. E. A. Stevens; P/O. L. E. Stubbs; Sgt. A. Sutcliffe; Flt. Sgt. E. J. Thorne; Sgt. C. G. L. Vallance; L.A/C. A. H. Vann; Flt. Sgt. F. W. Whittaker; Sqn. Ldr. A. B. Wilkinson; Sgt. T. G. Wilkinson; Sgt. F. H. Williams; P/O. J. H. Williams; Sgt. R. H. Willshire; Sgt. T. E. Witts.

WOUNDED OR INJURED IN ACTION.—Sgt. J. Armstrong; Sgt. F. W. Harvey; P/O. F. T. Kerr, F/O. R. Wilkinson.

MISSING, BELIEVED KILLED IN ACTION.—Flt. Lt. J. D. Clements; F/O. R. Gee; Sgt. G. B. Senior; W/O. E. R. Watkins; Flt. Lt. W. Wilson.

MISSING.—Flt. Sgt. A. A. Applegate; F/O. W. J. Bailey; Sgt. S. T. Bishop; Sgt. W. H. Botterill; Sgt. H. W. Bradbury; Flt. Sgt. S. T. Bulmer; Flt. Sgt. N. E. Cartwright; Sgt. J. T. Cashmore; Flt. Sgt. J. V. Collett; Sgt. H. Crabtree; Sgt. W. P. Cullen; Sgt. R. D. Davies; Flt. Sgt. D. A. Farrington; Act. Flt. Lt. C. V. French; P/O. R. H. Garbutt; Flt. Sgt. K. F. H. Hart; Sgt. W. F. Hearn; F/O. W. R. Henderson; Sgt. A. W. Horner; Flt. Sgt. D. H. Jackson; Sgt. W. P. J. King; Sgt. W. Lee; F/O. A. Lewis; Sgt. D. J. Lewis; F/O. J. F. Luing; F/O. D. McKenzie; P/O. E. V. Magee; Flt. Sgt. J. C. W. Marshall; Sgt. A. Newnham; F/O. J. J. O'Neill; Flt. Sgt. B. J. Owen; F/O. C. H. Pigg; Sgt. G. F. Pridham; F/O. F. N. Scott; Sgt. B. Simnett; Flt. Sgt. C. J. Singer; Flt. Sgt. J. W. Sole; Sgt. E. T. Stallard; Flt. Sgt. S. Sutton; P/O. S. R. Taylor; Sgt. P. W. Templer; Sgt. W. E. Thurnall; Sgt. A. N. Welch; Sgt. R. L. Wensley; F/O. G. J. White; Sgt. D. R. Williams; P/O. W. J. Wills; Flt. Sgt. J. M. Withers; Flt. Sgt. C. Woodington; Sgt. D. F. Wooldridge; Flt. Sgt. S. T. Worbey; Sgt. F. H. Worthington; F/O. H. C. Yarwood.

KILLED ON ACTIVE SERVICE.—L.A/C. K. G. Biggs; Sgt. W. Blumire; P/O. G. A. Bonnar; Sgt. J. Bramwell; Sgt. K. J. Brettell; F/O. A. E. Brown; Sgt. A. C. Edwards; L.A/C. D. J. Edwards; Sgt. J. G. Hall; Sgt. F. Hardman; Sgt. G. T. Hunter; Sgt. D. H. Kerr; Flt. Sgt. H. Kilduff; Flt. Sgt. C. M. F. Lamb; Sgt. J. A. Lancaster; Sgt. J. T. Mellish; Flt. Lt. R. Parker; Sgt. T. Pilley; Flt. Sgt. D. A. Potter; P/O. S. R. Schofield; Sgt. K. M. Snelling; Sgt. A. S. Tawse; Sgt. W. Turner; P/O. C. S. G. Wood; Sgt. W. W. Younger.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED ON ACTIVE SERVICE.—L.A/C. S. Rushin.

WOUNDED OR INJURED ON ACTIVE SERVICE.—Flt. Sgt. M. M. Clifford; P/O. J. C. Harris-Ward, D.F.C.; Sgt. A. J. Mellor; Flt. Lt. L. MacA. Nelson; Sgt. H. Turnbull.

DIED OF WOUNDS OR INJURIES RECEIVED ON ACTIVE SERVICE.—F/O. W. J. Coulter; Flt. Sgt. S. Davies; Sgt. J. O'Brien; Wing Cdr. P. MacK. Soren.

DIED ON ACTIVE SERVICE.—L.A/C. L. W. C. Bowman; A/C.2 L. W. Burton; L.A/C. D. J. Croswellor; Flt. Lt. R. B. Dumbrill; L.A/C. W. Edwards; A/C.2 R. L. Greening; Act. Cpl. C. F. Hill; L.A/C. J. G. Howe; A/C.1 R. Jarman; A/C.2 V. Jepson; Sqn. Ldr. M. Keegan, O.B.E., M.M.; Act. Sqn. Ldr. F. W. J. Last; L.A/C. W. F. Rudgeley; L.A/C. W. F. F. Tucker; A/C.1 M. H. Webster; Flt. Sgt. E. L. Winslade.

PREVIOUSLY REPORTED MISSING, NOW REPORTED PRISONER OF WAR.—P/O. W. R. J. Dingle, D.F.M.; Sgt. H. Law; A/C.2 A. B. Marshall.

Royal Australian Air Force

KILLED IN ACTION.—Flt. Sgt. J. W. S. Fisher; W/O. G. G. McLean; F/O. E. L. Truscott.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION. NOW PRESUMED KILLED IN ACTION.—F/O. L. J. Connors; P/O. M. T. Cotton, D.F.C.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Sgt. J. G. Beer; Flt. Sgt. L. J. Frazer; Sgt. J. H. Hogg; Flt. Sgt. S. J. King, Flt. Sgt. L. W. Moon; Sgt. C. J. Moore; L.A/C. J. Murdoch; Act. Flt. Lt. K. J. Neill; Flt. Sgt. W. Nickalls; Sgt. J. A. Pearce; Flt. Sgt. F. G. Phillips; P/O. A. P. Reed; F/O. K. L. Ridings; Flt. Sgt. D. Ross; F/O. B. J. Sheehy; Flt. Sgt. C. F. J. Truscott; Sgt. W. V. Williams.

MISSING BELILVED KILLED IN ACTION.—P/O. G. J. Ballard.

MISSING.—Flt. Sgt. R. S. Bray; Flt. Sgt. J. E. G. Buchanan; Act. Flt. Lt. L. D. Curnow; P/O. A. E. Dawson; Flt. Sgt. J. Dansie; W/O. G. R. De Fraine; W/O. V. Dickson; Flt. Sgt. K. B. Kemmis; Flt. Sgt. K. W. Kewish; P/O. L. A. Lawson; Flt. Sgt. N. J. Lees; Flt. Sgt. R. T. Lightbody; P/O. D. A. Priddle; Flt. Sgt. J. E. Richards; F/O. C. W. Sergell; P/O. W. C. Trewern; Flt. Sgt. L. C. Williamson; P/O. H. C. Wills; Flt. Sgt. K. M. Wilson; Flt. Sgt. J. F. Wood.

KILLED ON ACTIVE SERVICE.—Flt. Sgt. E. A. Jones; Sgt. K. S. McDonald.

FRESH HORSES: Newly arrived Mustangs at an assembly plant in Britain. They are still swathed in the grease and special wrappings which protects them while they cross the Atlantic as deck cargo.

Royal Canadian Air Force

KILLED IN ACTION.—W/O. P. A. Gallop; F/O. D. J. Shea.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Flt. Lt. E. G. Crockett; W/O. H. D'Aperng; F/O. J. C. Frizzell; Flt. Sgt. W. St. C. Hebb; Flt. Lt. O. B. Roberston.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Flt. Sgt. J. T. Kendall.

DIED OF WOUNDS OR INJURIES RECEIVED IN ACTION.—Sgt. F. K. Morris.

MISSING, BELIEVED KILLED IN ACTION.—W/O. O. A. Kerch.

MISSING.—Flt. Sgt. J. C. Calhoun; W/O. A. A. Cameron; W/O. L. E. Cox; Sgt. D. Crawley; F/O. D. I. Cruickshank; Sgt. J. R. Dutton; Sgt. E. F. Gillcash, Sgt. H. E. Hirst; Flt. Sgt. M. M. Hoffberg; F/O. J. D. C. Hooey; P/O. E. D. Kent; F/O. A. B. M. Ketterson; F/O. W. C. Kingsley; W/O. M. A. Knight; F/O. H. M. Long; Flt. Lt. D. W. McKay; Sgt. M. Minett; Sgt. D. B. Richardson; F/O. G. A. Roberts; F/O. H. M. Sherman; Flt. Sgt. C. W. Walmsley; F/O. A. L. Warren; F/O. J. Wright.

KILLED ON ACTIVE SERVICE.—P/O. G. C. Liggett; P/O. A. G. Lillico; Wing Cdr. R. F. MacDonald.

WOUNDED OR INJURED ON ACTIVE SERVICE.—F/O. A. F. Adams.

DIED OF WOUNDS OR INJURIES RECEIVED ON ACTIVE SERVICE.—Sgt. D. C. H. Adamson.

Royal New Zealand Air Force

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—F/O. J. A. Ainge; F/O. A. B. Smith; Flt. Lt. G. Stenborg, D.F.C.; Act. W/O. K. A. Toon.

MISSING BELIEVED KILLED IN ACTION.—Flt. Sgt. K. J. Hansen.

MISSING.—P/O. M. E. P. Barriball; Flt. Sgt. G. S. Hadfield; P/O. G. W. Rowberry.

KILLED ON ACTIVE SERVICE.—F/O. A. J. Galvin; Flt. Sgt. G. C. Jamieson.

DIED OF WOUNDS OR INJURIES RECEIVED ON ACTIVE SERVICE.—W/O. H. K. Williams.

South African Air Force

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Lt. C. Batchelor; Lt. C. A. Halliday; Lt. A. M. Hofmeyr; Flt. Sgt. W. K. Smook.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Lt. W. J. K. Bliss; Lt. D. B. Campbell; 2/Lt. W. O. Daniels; Lt. B. A. H. Erasmus; Lt. E. P. Hamilton; 2/Lt. C. F. Hodgkinson; Flt. Sgt. P. K. Human; Capt. C. G. Le Roux; Capt. G. L. McBride; Lt. J. F. G. Meredith; Flt. Sgt. U. J. Meyer; Lt. A. G. T. Oakes; Flt. Sgt. D. Phelan; Lt. K. Robinson; Maj. P. J. Schravesande; 2/Lt. S. C. Smith; Flt. Sgt. K. J. Stopforth; Lt. P. W. H. Truter; Lt. J. Van Dijl; Flt. Sgt. A. M. White; Lt. G. A. Wilkinson.

KILLED ON ACTIVE SERVICE.—2/Lt. A. J. Cronje.

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